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## (54) Fragmentable ring applier

Gerät zum Anbringen von zersplitterbaren Ringen

Applicateur de bagues fragmentables

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EP-A- 0 324 858

EP-A- 0 481 619

EP-A- 0 595 094

US-A- 4 304 236

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**Description****BACKGROUND OF THE INVENTION****1. Field of the Invention**

The present invention relates to surgical instruments used to perform circular anastomosis of tubular tissue sections and, more particularly, to a surgical instrument suitable for installation of multi-ring compression devices for circular anastomosis of tubular tissue sections. The disclosure of EP-A-595 094 (document under Art.54(3) EPC) includes drawings corresponding to accompanying drawings Figures 1 to 23. EP-A-324 858 discloses the technical features of the pre-characterising part of claim 1 below.

**2. Description of Related Art**

Some surgical procedures, such as repair of the colon, require the joining of two rather large sections of tubular tissue. During these procedures, a diseased area of tissue is excised leaving two free ends of healthy tissue to be joined. Some known methods of joining the tissues include stapling or suturing the ends together. A more recent advancement in the art, called a multi-ring compression device, is used to clamp the free ends of the tissue between a series of interlocking rings whose centers are then cut away.

Typically, a multi-ring compression device consists of an outer ring assembly which fits over an intermediary ring. The two rings are then locked together by inserting an inner ring in the intermediary ring which locks in place.

In use the free open ends of tissue are captured between the outer ring assembly and the intermediary ring. The entire assembly is then locked together by insertion of the inner ring. The inner core of the ring assembly is then cut away along with any excess tissue. The clamped tissue within the rings is deprived of blood causing necrosis to take place. The outer tissue heals while the necrosised inner tissues and clamps are detached and expelled by the body. Newer clamps or compression rings, such as those shown in U.S. Patent No. 4,966,602, have a fragmentable structure which enhances the bodies ability to expel the device.

Various surgical instruments have been developed to install the multi-ring compression devices. One known surgical instrument used to install the compression rings is shown in U.S. Patent No. 4,681,108 to Rosati et al. This instrument generally comprises a cylindrical housing having means for aligning the rings within the tubular tissue sections, driving means for clamping the rings together in locking arrangement around the tissue sections and cutting means for removing excess tissue ends and detaching the instrument from the rings. In the Rosati et al. instrument, the cutting means consists of an advancing circular blade which both cuts the tissue and rings and pushes the

rings free of the instrument in one continuous stroke.

Another known instrument for installing multi-ring compression devices is shown in U.S. Patent No. 4,907,591 to Vasconcellos et al. This instrument includes such features as a rotating cutting blade and locking means to isolate the operation of aligning and clamping the rings from the separate continuous operation of cutting the excess tissue and freeing the instrument from the tissue.

Still other instruments, such as the flexible bronchoscope shown in U.S. Patent No. 4,880,015 to Nierman, include provisions for insertion of accessory instruments such as biopsy forceps through the instrument in order to access the operative site. U.S. Patent No. 4,817,847 to Redtenbacher discloses a circular stapling device having a removable anvil head provided with means to attach an endoscope to the anvil head.

**SUMMARY AND OBJECTIVES OF THE INVENTION**

The characteristic technical features of the present invention are recited in claim 1 below and provides a surgical instrument suitable for insertion and assembly of multi-ring compression ring devices for circular anastomosis of tubular or hollow organ tissue sections such as, for example, the stomach, colon, etc. The instrument may comprise a body having means to support and align the rings, means for clamping the rings around the free ends of the tissue sections, means for coring away excess clamped tissue and the centers of the rings, separate means for releasing the clamped rings from the instrument and dwell means to delay releasing the rings until after the coring operation is complete. The instrument may additionally include means for detaching a portion of the support means to facilitate installation and alignment, safety means to ensure safe operation and means for supplying various knife blade profiles.

In one embodiment of the invention a continuous bore extends longitudinally throughout the length of the instrument to provide a passageway for accessory instruments such as, for example, endoscopes, graspers, cutters and the like.

Additionally, lockout means may be provided to prevent coring of the tissue sections until they have been clamped.

It is an object of the present invention to provide means to protect the user when the knife blade is in a proximalmost position.

The invention can provide venting means to prevent excessive pressure build-up in the device during clamping of the rings about tissue.

Other novel features and objects of the invention will become evident from the following detailed description of the invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The description which follows is given with refer-

ence to the drawings wherein:

Fig. 1 is an overall perspective view of a ring applier instrument;

Fig. 2 is an enlarged side detail view of the handle portion of the instrument;

Fig. 3 is an exploded perspective view of the instrument;

Fig. 4 is an enlarged side detail view of the head portion of the instrument of Fig. 1 showing retraction of an outer ring over an intermediary ring;

Fig. 5 is a similar view thereof showing insertion of an inner locking ring into said intermediary ring;

Fig. 6 is a similar view thereof showing the advancement of the coring means through the outer ring;

Fig. 7 is a similar view thereof showing the release of the coupling assembly from the present invention;

Figs. 8a and 8b are side and top detail views of the shifter keys;

Fig. 9 is a perspective view of a diseased section of the colon being excised and showing a detachable portion of the instrument deployed in a distal section of the colon;

Fig. 10 is a perspective view showing the trocar points pulled through the stapled edges of the tissue;

Fig. 11 is a perspective view showing a detachable trocar point being removed by grippers;

Fig. 12 is a perspective view showing the detachable assembly being attached to the instrument;

Fig. 13 is a perspective view of the colon just prior to clamping the ring assemblies;

Figs. 14a, 14b and 14c are views of various knife blade profiles;

Fig. 15 is a perspective view showing an alternate double handle embodiment of the instrument;

Fig. 16 is a side detail view of the handle portion of an alternative instrument;

Figs. 17a, 17b, 17c and 17d are top and side detail views of one variation of the external cup including associated trocar tip and center rod;

5 Figs. 18a, 18b, 18c and 18d are detail views of other varying external cup portions of the alternative instrument incorporating another variation of the detachable outer ring support and associated trocar tips;

Fig. 19a, 19b, 19c, 19d and 19e are detail views of a female outer ring;

10 Figs. 20a, 20b, 20c, 20d and 20e are detail views of a male outer ring;

Figs. 21a, 21b, 21c and 21d are detail views of an intermediate ring;

15 Figs. 22a, 22b, 22c and 22d are detail views of an inner ring;

Fig. 23 is an exploded perspective view of an alternate embodiment of the instrument;

20 Fig. 24 is a perspective view of a first embodiment of the invention;

Fig. 25 is exploded perspective view of the body portion and retractor portion of the Fig. 24 instrument

25 Fig. 26 is an exploded perspective view of the head portion of Fig. 24;

Fig. 27 is a perspective view, partially shown in section, of the head portion;

30 Fig. 28 is a partial plan view of a band attachment means;

Fig. 29 is an enlarged exploded view of a lockout mechanism utilized in the device of Fig. 24;

35 Fig. 30 is a partial side perspective view of the body portion;

Fig. 31 is a perspective view, partially shown in section, of the instrument of Fig. 24, illustrating the throughbore;

40 Fig. 32 is a perspective view, partially shown in section, of the instrument of Fig. 31, with an accessory instrument inserted therethrough;

45 Fig. 33 is an enlarged side cross-sectional detail view of the head portion of the embodiment of the Fig. 24 showing an outer ring retracted over an intermediary ring;

50 Fig. 34 is a view similar to Fig. 33 showing insertion of an inner locking ring;

Fig. 35 is a view similar to Fig. 34 showing advancement of the coring means through the outer ring; and

Fig. 36 is a view similar to Fig. 35 showing the release of the assembled ring assembly from the frame.

#### DETAILED DESCRIPTION OF THE INVENTION

With reference to Figs. 1 to 23 of the drawings wherein like numerals represent identical parts throughout the several views, and more particularly with reference to Fig. 1, the ring applier 10 generally includes a body portion 12, a head portion 14 and a retractor portion 16 extending through body portion 12 and head portion 14. An external tube 18 joins head portion 14 to body portion 12.

For a detailed description of what is shown in Figs. 1 to 23, the reader is referred to EP-A-595 094. However, the text which follows and which describes Figs 24 to 36 is readily understood without such reference. The remaining presence of Figs. 1 to 23 nevertheless assists understanding of the present invention.

A first embodiment of the present invention is illustrated in Fig. 24 wherein ring applier 300 generally includes a body portion 302, a head portion 304 and a retractor portion 306 extending through body portion 302 and head portion 304.

As shown in Fig. 25, body portion 302 is comprised of a pair of body halves 308 which, when combined by alignment pins 309, and fastened together by means of bushing inserts 310 and screws 312, form an elongated front end tube 314, preferably curved, having a cavity 316 therein. Body halves 308 have wing shaped back ends 318 which, when combined, form a cavity 320 communicable with cavity 316. A shrink wrap 322 may be provided to aid in holding body halves 308 together and present a smooth outer surface when ring applier 300 is assembled. Body portion 302 further includes a pair of handles 324, pivotally and opposingly mounted on bushing insert 310, each handle 324 having an inwardly directed front end 326 extending through cavity 320 and into cavity 316. A knife cam 328 is slidably disposed within cavity 316 on side grooves 330 formed within body halves 308 and is in abutting contact with inwardly extending front ends 326 of handles 324 such that pivoting handles 324 together forces knife cam 328 forward within cavity 316. A knife retractor spring 332 is located within body portion 302, and positioned between flange 334 on body halves 308 and knife cam 328, to bias knife cam 328 rearwardly.

A pair of semicircular guide inserts 336 are disposed within tube cavity 316 and extend therethrough. Each insert 336 has a pair of longitudinally extending projections 338 along each of their respective longitudinal edges such that, when paired in abutting relation to form a complete tube, and positioned within mating body halves 308, define inner 340 and outer 342 pairs

of coaxial and longitudinally extending channels, similar to channels 240 and 242 described hereinabove with respect to ring applier 200, in inserts 336.

Referring to Figs. 26 and 27 head portion 304 is similar to head portion 14 referred to above and contains similar parts/elements recited therein including pusher 346 having integral shifter keys 348, knife holder 350 and knife blade 352 which function together in the same manner recited hereinabove. Specifically, referring now to Fig. 26 head portion 304 comprises an external cup 354 having a rear portion 356 and a front portion 358. Rear portion 356 includes a plurality of flexible fingers 360 at a proximal end and a threaded interior 362. A support ring 344 (Fig. 25) is provided to hold fingers 360 against body halves 308 thereby securing rear portion 356 to body halves 308.

Front portion 358 has a grooved distal end 364 for support of intermediary ring 52 and is threadably engageable with rear portion 356 of external cup 354 thereof by means of threaded surface 366. As best seen in Fig. 27, front portion 358 forms an enlarged bore area 368 at a distal end and a reduced area portion 370 at a proximal end beneath threaded surface 366. Front portion 358 has a plurality of crosswise support members 372 extending inwardly within enlarged bore area 368. Support members 372 meet within enlarged bore area 368 at a center boss 374 which surrounds a centerline of ring applier 300 to maintain an unobstructed bore therethrough and for support of a knife shield 376 as described hereinbelow.

Front portion 358 of external cup 354 further includes a plurality of dwell recesses 378 located on an inner surface 380 (Fig. 27) of front portion 358 and disposed within a threaded section 366 of front portion 358 to guide shifter keys 348.

Additionally, front portion 358 and rear portion 356 may be provided with venting means similar to that described in U.S. Patent No. 4,304,236 to Conta et al. including vent holes 359 (Figs. 26, 31 and 32).

Pusher 346 (Fig. 26), having resilient means in the form of a pair of flexible arms 382 which terminate in integral shifter keys 348 and having a pair of relatively rigid driving arms 384, is slidably disposed within external cup 354. Pusher 346 further has a circumferential flange 386 at a distal end which resides in enlarged bore area 368 of external cup 354. The longitudinal openings between arms 382 and driving arms 384 facilitate sliding pusher 346 around crosswise support members 372. Pusher 346 slidably supports inner ring 72 within enlarged bore area 368 of external cup 354.

Knife holder 350 has a circumferential flange 388 at a proximal end and is slidably disposed within pusher 346. Knife holder 350 further includes a plurality of support arms 390 having outwardly projecting tabs 392 for engagement with flexible end portions 394 of circular knife blade 352 to affix knife blade 352 to a distal end of knife holder 350. Engagement means in the form of shifter key recesses 396 are formed on an outer surface of two opposing support arms 390. A plurality of longitu-

dinal channels 391 between arms 390 slidably surround support members 372, respectively, and when combined with knife blade 352 serve to limit the travel of the assembled knife blade 352 and holder 350 within external cup 354. Finally knife shield 376 is disposed within knife blade 352 and frictionally engages central boss 374. Knife shield 376 projects past knife blade 352, when knife blade 352 is in a proximalmost position, to protect the user.

The motion of handles 324 is transmitted to knife holder 350 by means of a pair of knife bands 400 (Fig. 25) which are slidably supported within outer channels 342 and extend therethrough. Knife bands 400 are affixed to knife cam 328 at a proximal end by means of pins 402 and to knife holder 350 at a distal end by means of pins 404 such that pivoting handles 324 slides knife holder 350 within pusher 346 thereby transmitting the motion of handles 324 through inserts 336 in front end cavity 316.

In an alternate embodiment, knife bands 400a are substituted for knife bands 400 and knife holder 350a is substituted for knife holder 350. Ends 406 of knife bands 400a are affixed to knife holder 350a and knife cam 328 by means of flared projections 408 on ends 406 of bands 400 and corresponding notches 410 on knife holder 350a and knife cam 328 as shown in Fig. 28. This arrangement eliminates the need for pins 402 and 404 and facilitates maintaining an open channel throughout ring applier 300.

Referring to Figs. 25, 29 and 30, ring applier 300 is preferably provided with a wing safety 412 rotatably mounted on wing shaped back ends 318 and positioned between handles 324 such that safety 412 blocks movement of handles 324 in a first position and allows free movement of handles 324 when safety 412 is rotated to a second position. Springs 413 are provided between wing safety 412 and wing shaped back end to bias wing safety 412 into the first or locked position.

At a proximal end of ring applier 300, as shown in Fig. 25, retractor portion 306 includes a barrel 414, defining a bore 416, and rotatably attached to wing shaped back end 318 at a distal end, which extends backwards from wing shaped back end 318 and is centered between opposing handles 324. A tail member 418, defining a bore 420 communicable with wing cavity 320 is rigidly affixed to barrel 414 by means of screws 422 at a distal end of barrel 414 for rotatable support of tail member 418 on wing shaped back end 318. Flange 424 on barrel 414 rotates within grooves 426 (Fig. 29) on body halves 308.

A cam-clamp 428 (Fig. 25) having a variable helical depression 430 on an outer surface thereof, and defining a bore 432 is slidingly suspended within barrel bore 416 by means of a guide tube 434 which is affixed to wing shaped back end 318 at a first end and extends through bore 432 in cam-clamp 428 to guide cam-clamp 428 within barrel bore 416. Variable helical depression 430 in cam-clamp 428 is initially of a slow rate of twist at a proximal end of cam-clamp 428 to provide a rapid ini-

tial approximation of rings 52 and 94. At the distal end of cam-clamp 428 the helical depression 430 changes to a rapid rate of twist to provide slower more precise approximation of rings 52 and 94 and to provide increased torque for clamping rings 52 and 94 around ends of tubular tissue sections.

A barrel insert 436 is attached to a proximal end of barrel 414 by means of pins 438. A guide pin 440 is rigidly affixed to barrel insert 436 at a proximal end thereof such that a free end of pin 440 extends into and engages helical depression 430 of cam-clamp 428. By rotating tail member 418, barrel 414 drives pin 440 in helical depression 430, thereby drawing cam-clamp 428 rearwardly along guide tube 434 initially at a fast rate and subsequently in a slower, stronger and more precise fashion.

Referring again to Figs. 26 and 27, retractor portion 306 further includes a shortened clamp rod 442 extending into external cup 354 at a proximal end thereof and having slots 444 to allow the tube neck 444a to expand to create a snap-fit type of engagement with a center rod assembly 98 similar to that referred to above in ring applier 10 and is supplied with a similar trocar tip 99.

As shown in Fig. 25, retractor portion 306 further includes a pair of clamp bands 446 slidably suspended within inner channels 340 and attached at distal ends thereof to clamp rod end 448 (Fig. 26) by insertion of band 446 into slots 450 of clamp rod end 448 and affixed thereto by means of pins 452. Bands 446 are affixed to cam-clamp 428 at proximal ends thereof by means of pins 454. Clamp rod end 448 is affixed around clamp rod 442 to connect clamp bands 446 thereto. Turning tail member 418 moves cam-clamp 428, and thus center rod assembly 98, axially thereby transmitting the motions of cam-clamp 428 through channels 340 to center rod assembly 98. Alternatively, clamp bands 446 may be connected to clamp rod end 448 and cam-clamp 428 by means of the flared projections/notches system described with respect to knife bands 400 hereinabove.

A particularly advantageous feature of ring applier 300, as shown in Figs. 29 and 30, is lockout means in the form of a lockout safety 456 which prevents turning wing safety 412 unless and until clamp band 446 is fully retracted. Lockout safety 456 includes a lock plate 458 slidably supported within plate channel 460 formed in wing shaped back end 318. Lock plate 458 includes a centrally positioned dog leg shaped engagement leg 462 and a lock tab 464 at a proximal end for engagement with a metal insert 470, which is located in notched area portion 472 of wing safety 412. Projection 466 is provided at a proximal end of one clamp band 446 to contact and move engagement leg 462. A lock spring 468 is provided to bias lock plate 458 distally in a locked position. Also included is a display slide 474 and leaf springs 476 disposed between lock plate 458 and wing shaped back end 318 such that slide 474 is visible through window 478 in wing shaped back end 318. An indicator mark 480 on display slide 474 shows through

window 478 and indicates when clamp band 446 is fully retracted and ring applier 300 is ready to fire.

In a preferred embodiment of ring applier 300, a longitudinal through bore 482 (Fig. 31) extends throughout the length of ring applier 300 to allow accessory instruments such as endoscopes, grasping or cutting forceps, and the like to be inserted into ring applier 300 at a proximal end and be communicable with a distal end of ring applier 300. As best illustrated in Figs. 31 and 32, throughbore 482 extends through guide tube 434 positioned within tail bore 420 in tail member 418. As noted above, guide tube 434 is affixed to wing shaped back end 318 and extends into wing cavity 320. A channel 484 is formed by paired guide inserts 436, within tube cavity 316 in front end tube 314. Bore 482 continues from wing cavity 420 through channel 484 which is communicable with wing cavity 420.

In this embodiment it can be readily appreciated that to maintain an unobstructed bore 482 throughout ring applier 300, knife cam 328 must contain a cavity 486 as shown in Figs. 25 and 31, to allow a continuous communicable passageway through wing cavity 320. Additionally, inwardly directed ends 326 (Fig. 25) of pivotable handles 324 should allow enough clearance around bore 482 so as not to obstruct bore 482.

As shown in Fig. 25, paired inserts 336, and thus channel 484, terminate within cavity 316 proximally of head portion 304. Therefore, bore 482 extends on through tube cavity and is coaxial therewith. In the preferred embodiment, knife holder 350 is hollow having a knife bore 488 (Fig. 26) coaxial and communicable with tube cavity 316. Thus bore 482 continues from channel 484 through tube cavity 316 and on through knife holder 350. Finally, bore 482 extends through and exits out a distal end of clamp rod 442 which is also communicable and coaxial with tube cavity 316.

Preferably, bore 482 is of circular cross section having a minimum inner diameter on the order of approximately 2 to 6 millimeters and more preferably approximately 5 millimeters.

An endoscope 490 may be inserted through bore 482, as best shown in Fig. 32. Typically endoscope 490 includes a barrel section 492 which extends through bore 482 and terminates in a lens 494 located at a distal end of barrel section 492.

While the provision of a relatively rigid endoscope has been illustrated with respect to the straight bodied ring applier of Fig. 32, it is within the contemplated scope of the invention to provide curved bodied ring applier 300 with a relatively flexible endoscope for use therein. And while the provision of a longitudinally extending bore has been described with regard to the present ring applier, it is within the contemplated scope of the invention to provide other surgical instruments with a bore therethrough to provide auxiliary access to the operative site for accessory instruments, such as, for example, endoscopes, graspers, cutters and the like.

In use, ring applier 300 is readied and operated in similar fashion to ring applier 10 as shown in Figs. 9-13.

In one embodiment of ring applier 300, after center rod assembly 98 has been deployed in a distal section of tubular or hollow organ tissue, trocar tip 104 is removed from the surgical field by grippers (Fig. 11) prior to attaching center rod assembly 98 to clamp rod similar to that shown in Fig. 18b hereinabove.

After ring applier 300 has been inserted into a patient an endoscope may be inserted through bore 482, as best shown in Fig. 25. Endoscope 490 may be used to locate and view the areas of tissue to be joined. Additionally, gripping or cutting devices may be inserted through bore 482 to grasp or cut sutures or tissue or the like at the operative site before or after anastomosis.

Turning tail member 418, analogous to the turning of clamp knob 34 above, draws cam-clamp 428 rearward initially a rapid rate to provide quick approximation of rings 52 and 94 and subsequently at a slower rate for more precise approximation of rings 52 and 94. Increased torque accompanies the slower approximation rate to apply a higher clamping force between rings 52 and 94 and the tissue section clamped therebetween.

In the embodiments with the lockout safety 456, lock tab 464 is initially biased by spring 468 into engagement with metal insert 470 thereby locking wing safety 412 from rotation. When clamp band 446 is fully drawn rearwardly, projection 466 abuts engagement leg 462 moving lock plate 458, and thus lock tab 464, proximally out of engagement with metal insert 470 and into notched area portion 472 of wing safety 412 allowing wing safety 412 to turn freely. Indicator mark 480 shows through window 478 indicating that cam-clamp 428 is fully retracted and that wing safety 412 is free to rotate thereby unblocking handles 324.

The pivoting of handles 324 is analogous to the pivoting of handles 24 above in that the knife holder 350 is forced forward carrying with it pusher 346 to initially insert locking inner ring 72 into intermediary ring 52.

However, in the aforementioned embodiments, the shifter keys moved within shifter key channels located within the pusher. In ring applier 300, shifter keys 348, being integral with flexible arms 382 of pusher 346, are biased into engagement with shifter key recesses 396 in knife holder 350 when in reduced area portion 370 (Fig. 33). Thus pusher 346 moves with knife holder 350 as handles 324 are pivoted to insert inner ring 72 into intermediary ring 52. When inner ring 72 is fully inserted, shifter keys 348 flex outwardly (Fig. 34) into enlarged area portion 368 of external cup 354 and out of shifter key recesses 396. Disengaging pusher 346 from knife holder 350 allows knife blade 352 to advance independently of pusher 346 to core the centers of rings 94 (Fig. 35) and tissue clamped therebetween in a manner similar to that described hereinabove. Thus shifter keys 348 serve to alternately engage and disengage pusher 346 from knife holder 350 and thus preventing release of the assembled rings prior to completion of coring of the excess tissue. After coring, flange 388 on knife holder 350 abuts driving arms 384 of pusher 346 to finally push

assembled rings free from grooved distal end 364 of front portion 358 and thus from ring applier 300 (Fig. 36).

As noted above, support members 372 (Fig. 27) serve to limit the travel of knife and pusher 346. After handles 324 are released, spring 332 biases knife cam 328 proximally thereby drawing knife blade 352 proximally. Knife shield 376 projects past a distal end of knife blade 352 when knife blade 352 is in the proximalmost position to protect the user.

The claims which follow identify embodiments of the invention additional to those described in detail above.

#### Claims

1. A surgical instrument (300) for application of surgical fasteners to a first hollow organ tissue section and a second hollow organ tissue section for anastomosis thereof, said surgical instrument comprising:
  - (a) a frame portion (302);
  - (b) retraction means (306) slidably disposed within said frame portion for collecting a first tissue section and a second tissue section to be fastened;
  - (c) pushing means (346) slidably disposed within said frame portion for application of surgical fasteners to the collected first and second tissue sections;
  - (d) coring means (350, 352) slidably disposed within said frame portion, and engageable with said pushing means for advancement thereof, for coring excess tissue captured between the collected first and second tissue sections; and
  - (e) resilient means (348) associated with said pushing means for alternately engaging and disengaging said pushing means with said coring means, wherein said resilient means engages said pushing means with said coring means during application of the surgical fasteners and said resilient means disengages said pushing means from said coring means during coring; and wherein:
  - (f) said coring means includes a knife assembly (350), having a blade member (352) at a distalmost end for cutting said excess tissue, said knife assembly having engagement means (396) for engaging said resilient means; and the instrument being characterised by:
  - (g) a knife shield (376) affixed to said frame portion (302) and extending distally of said blade member (352) when said blade member is in a proximalmost position.
2. The surgical instrument as recited in claim 1 wherein said resilient means includes at least one shifter member (348) flexibly affixed to said pushing

means such that said shifter member engages said engagement means (396) during application of the surgical fasteners and disengages from said engagement means during coring of the excess tissue.

3. The surgical instrument as recited in claim 2 wherein said engagement means comprises a recess (396) in said knife assembly (350) and wherein said frame portion includes a chamber at a distal end thereof having an enlarged area portion (368) and a reduced area portion (370) proximal of said enlarged area portion, said at least one shifter member being resiliently biased away from said recess such that when said at least one shifter member and said recess are within said reduced area portion of said frame portion said shifter member is urged into engagement with said recess thereby engaging said pushing means with said coring means, and when said at least one shifter member and said recess are advanced into said enlarged area portion of said frame portion said at least one shifter member is biased out of engagement with said recess thereby disengaging said pushing means from said coring means.
4. The surgical instrument as recited in claim 3 wherein the surgical fasteners (52, 72, 94) include at least a first ring (94) and a second ring (72) for fastening the first and second tissue sections therebetween.
5. The surgical instrument as recited in claim 4 wherein said retraction means comprises:
  - (a) support means (414) located distally of said frame portion for holding said first ring;
  - (b) a tail member (418) rotatably mounted at a proximal end of said frame portion; and
  - (c) a retraction transmission assembly (98) affixed at a distal end to said support means and engageable at a proximal end with said tail member such that rotation of said tail member causes axial movement of said retraction transmission assembly, and thus of said support means;

wherein said pushing means includes a pusher member (346) having a circumferential flange (386) adapted to support said second ring (72) during coring of the first and second tissue sections after fastening, whereby,

  - (a) rotating said tail member (418) draws said first ring (94) proximally adjacent said frame portion collecting the first and second tissue section therebetween;
  - (b) initial distal movement of said knife assembly through said frame portion allows said

- shifter member (348) to engage said engagement means thus moving said pusher member through said frame portion driving said second ring into fastening relationship with said first ring thereby capturing the first and second tissue sections therebetween; and
- (c) further distal movement of said knife assembly through said frame portion allows said shifter members to bias out of engagement with said engagement means of said knife assembly allowing said knife assembly to advance distally independently of said pusher member to thereby core excess tissue captured between said first ring and said second ring.
6. The surgical instrument as recited in claim 5 wherein a distalmost portion of said enlarged area of said frame portion is adapted to support a third ring (52) such that rotating said tail member draws said first ring over said third ring to collect the first and second tissue sections therebetween, and advancing said pusher member forces said second ring (72) into locking engagement with said third ring thereby fastening the first and second tissue sections.
7. The surgical instrument as recited in any one of the claims 1 to 6 further comprising a spring member (332) for biasing said blade member in a proximal most position.
8. The surgical instrument as recited in any one of the preceding claims, wherein said frame portion and said retraction means co-define a bore (482) extending axially throughout the length of the instrument and adapted to receive accessory instruments therethrough.
9. The surgical instrument as recited in any one of the preceding claims, further comprising lockout means (456) associated with said frame portion for blocking movement of said coring means until the first tissue section and the second tissue section are substantially collected by said retraction means.
10. The surgical instrument as recited in any one of the preceding claims, further comprising venting means (359) to allow escape of excess air pressure between the collected first and second tissue sections and from within the instrument.
- Patentansprüche**
- Chirurgisches Instrument (300) zum Anbringen von chirurgischen Befestigern an einem ersten hohlen Organgewebeabschnitt und einen zweiten hohlen Organgewebeabschnitt zur Anastomose derselben, wobei das chirurgische Instrument umfaßt:
- 5
- (a) einen Rahmenbereich (302);  
 (b) eine Zurückzieheinrichtung (306), die verschiebbar innerhalb des Rahmenbereichs angeordnet ist, um einen ersten und einen zweiten zu befestigenden Gewebeabschnitt aufzunehmen;  
 (c) eine Schiebeeinrichtung (346), die verschiebbar innerhalb des Rahmenbereichs angeordnet ist, um chirurgische Befestiger an den aufgenommenen ersten und zweiten Gewebeabschnitten anzubringen;  
 (d) eine Aushöleinrichtung (350, 352), die verschiebbar innerhalb des Rahmenbereichs angeordnet ist und in Eingriff treten kann mit der Schiebeeinrichtung zum Vorrücken derselben, um zwischen den aufgenommenen ersten und zweiten Gewebeabschnitten gegriffenes Überschüttgewebe auszuhöhlen; und  
 (e) eine elastische Einrichtung (348), die der Schiebeeinrichtung zugeordnet ist, um abwechselnd in Eingriff zu treten mit der Schiebeeinrichtung und aus dieser auszurücken mit der Aushöleinrichtung, wobei die elastische Einrichtung die Schiebeeinrichtung in die Aushöleinrichtung während des Anbringens der chirurgischen Befestiger einrückt und die elastische Einrichtung die Verschiebeeinrichtung aus der Aushöleinrichtung während des Ausöhlns ausrückt; und  
 wobei:  
 (f) die Aushöleinrichtung einen Messeraufbau (350) umfaßt, mit einem Schneideelement (352) an einem am weitesten distal gelegenen Ende, um das Überschüttgewebe zu schneiden, wobei der Messeraufbau eine Eingriffseinrichtung (396) zum Ineingriffreten mit der elastischen Einrichtung besitzt; und wobei das Instrument dadurch gekennzeichnet ist, daß:  
 (g) ein Messerschild (376) am Rahmenbereich (302) befestigt ist und sich in distalster Richtung von dem Schneidelement (352) erstreckt, wenn das Schneideelement in einer am weitesten proximal gelegenen Position ist.
- 20
2. Chirurgisches Instrument gemäß Anspruch 1, wobei die elastische Einrichtung zumindest ein Verschiebeelement (348) umfaßt, das biegsam so an der Verschiebeeinrichtung befestigt ist, daß die Verschiebeeinrichtung in Eingriff tritt mit der Eingriffseinrichtung (396) während des Anbringens der chirurgischen Befestiger und von der Eingriffseinrichtung während des Ausöhlns des Überschüttgewebes ausrückt.
- 25
3. Chirurgisches Instrument gemäß Anspruch 2, wobei die Eingriffseinrichtung umfaßt: eine Aussparung (396) in dem Messeraufbau (350), und wobei d r Rahmenbereich eine Kammer an einem distalen Ende desselben mit einem Bereich (368) mit
- 30
- 35
- 40
- 45
- 50
- 8

- vergrößerter Querschnittsfläche und einem Bereich (370) mit verringriger Querschnittsfläche proximal zu dem Bereich mit vergrößerter Querschnittsfläche umfaßt, wobei das zumindest eine Verschiebelement elastisch von der Aussparung so weg vorgespannt ist, daß, wenn das zumindest eine Verschiebeelement und die Aussparung innerhalb des Bereichs mit verringriger Querschnittsfläche des Rahmenbereichs sind, das Verschiebeelement in Eingriff mit der Aussparung gedrückt wird und damit die Schiebeeinrichtung mit der Aushöhlseinrichtung in Eingriff tritt, und, wenn das zumindest eine Verschiebeelement und die Aussparung in den Bereich mit vergrößerter Querschnittsfläche des Rahmenbereiches vorgerückt werden, das zumindest eine Verschiebeelement aus dem Eingriff mit der Aussparung heraus vorgespannt wird und damit die Schiebeeinrichtung von der Aushöhlseinrichtung ausrückt.
4. Chirurgisches Instrument gemäß Anspruch 3, wobei die chirurgischen Befestiger (52, 74, 94) zumindest einen ersten Ring (94) und einen zweiten Ring (72) zum Befestigen der ersten und zweiten Gewebeabschnitte dazwischen umfassen.
5. Chirurgisches Instrument gemäß Anspruch 4, wobei die Zurückzieheinrichtung umfaßt:
- (a) eine Stützeinrichtung (414), die distal vom Rahmenbereich angeordnet ist, um den ersten Ring zu halten;
  - (b) ein Endstückelement (418), das drehbar an einem proximalen Ende des Rahmenbereiches befestigt ist; und
  - (c) einen Zurückzieh-Übertragungsaufbau (98), der an einem distalen Ende an der Stützeinrichtung befestigt ist und an einem proximalen Ende mit dem Endstückelement so in Eingriff zu bringen ist, daß eine Drehung des Endstückelements zu einer axialen Bewegung des Zurückzieh-Übertragungsaufbaus und somit der Stützeinrichtung führt;
- wobei die Schiebeeinrichtung ein Schieberelement (346) umfaßt, mit einem Umfangsflansch (386), der dazu geeignet ist, den zweiten Ring (72) während des Aushöhlens der ersten und zweiten Gewebeabschnitte nach dem Befestigen zu halten, wobei
- (a) ein Drehen des Endstückelements (418) den ersten Ring (94) in proximaler Richtung neben den Rahmenbereich zieht und den ersten und zweiten Gewebeabschnitt dazwischen aufnimmt;
  - (b) eine anfängliche distale Bewegung des Messeraufbaus durch den Rahmenaufbau es gestattet, daß das Verschiebelement (348) in
- Eingriff tritt mit der Eingriffseinrichtung und somit das Schieberelement durch den Rahmenbereich bewegt und den zweiten Ring in eine Befestigungsbeziehung mit dem ersten Ring treibt und somit die ersten und zweiten Gewebeabschnitte dazwischen greift; und
- (c) eine weitere distale Bewegung des Messeraufbaus durch den Rahmenaufbau es den Verschiebeelementen gestattet, aus dem Eingriff mit der Eingriffseinrichtung des Messeraufbaus heraus vorgespannt zu werden und es dem Messeraufbau gestatten, in distaler Richtung unabhängig von dem Schieberelement vorzurücken und somit zwischen dem ersten Ring und dem zweiten Ring gegriffenes Überschüssegewebe auszuholen.
6. Chirurgisches Instrument gemäß Anspruch 5, wobei ein am weitesten distal gelegener Bereich des vergrößerten Querschnitts des Rahmenbereiches dazu geeignet ist, einen dritten Ring (52) so zu halten, daß ein Drehen des Endstückelements den ersten Ring über den dritten Ring zieht, um die ersten und zweiten Gewebeabschnitte dazwischen aufzufangen, und das Vorrücken des Schiebelements den zweiten Ring (72) in einen verriegelnden Eingriff mit dem dritten Ring drückt und damit die ersten und zweiten Gewebeabschnitte befestigt.
7. Chirurgisches Instrument gemäß einem der Ansprüche 1 bis 6, weiter umfassend ein Federelement (332), um das Schneidenelement in eine am weitesten proximal gelegene Position vorzuspannen.
8. Chirurgisches Instrument gemäß einem der vorhergehenden Ansprüche, wobei der Rahmenbereich und das Mittel zum Zurückziehen gemeinsam eine Bohrung (482) begrenzen, die sich in axialer Richtung über die Länge des Instrumentes erstreckt und dazu geeignet ist, Hilfsinstrumente durch diese hindurch aufzunehmen.
9. Chirurgisches Instrument gemäß einem der vorhergehenden Ansprüche, weiter umfassend eine Verriegelungseinrichtung (456), die dem Rahmenbereich zugeordnet ist, um eine Bewegung der Aushöhlseinrichtung zu blockieren, bis der erste Gewebeabschnitt und der zweite Gewebeabschnitt im wesentlichen durch die Zurückzieheinrichtung aufgenommen sind.
10. Chirurgisches Instrument gemäß einem der vorhergehenden Ansprüche, weiter umfassend eine Entlüftungseinrichtung (359), um das Entweichen von überschüssigem Luftdruck zwischen den aufgenommenen ersten und zweiten Gewebeabschnitten und von innerhalb des Instrumentes zu

gestatten.

### Revendications

1. Instrument chirurgical (300) pour l'application d'attaches chirurgicales à une première section de tissu d'organe creux et une deuxième section de tissu d'organe creux pour l'anastomose de celles-ci, ledit instrument chirurgical comportant:
  - a) une portion de châssis (302);
  - b) un moyen de rétraction (306) disposé de manière coulissante dans ladite portion de châssis pour réunir une première section de tissu et une deuxième section de tissu à attacher;
  - c) un moyen pousoir (346) disposé de manière coulissante dans ladite portion de châssis pour appliquer des attaches chirurgicales aux première et deuxième sections de tissu réunies;
  - d) un moyen de découpe (350, 352) disposé de manière coulissante dans ladite portion de châssis et pouvant être mis en prise avec ledit moyen pousoir pour l'avancement de celui-ci, pour découper le tissu excédentaire enfermé entre les première et deuxième sections de tissu réunies; et
  - e) un moyen élastique (348) associé audit moyen pousoir pour une mise en et hors prise alternative dudit moyen pousoir avec ledit moyen de découpe, où ledit moyen élastique met en prise ledit moyen pousoir avec ledit moyen de découpe pendant l'application des attaches chirurgicales, et ledit moyen élastique met hors prise ledit moyen pousoir dudit moyen de découpe pendant la découpe; et où:
    - f) le moyen de découpe comporte un ensemble de couteau (350), avec un élément de lame (352) à l'extrémité la plus distale pour couper ledit tissu excédentaire, ledit ensemble de couteau comportant un moyen d'engagement (396) pour venir en prise avec ledit moyen élastique; et l'instrument étant caractérisé par:
      - g) une protection de couteau (376) fixée à ladite portion de châssis (302) et s'étendant distalement dudit élément de lame (352) lorsque ledit élément de lame se trouve dans une position la plus proximale.
2. Instrument chirurgical selon la revendication 1, où ledit moyen élastique comporte au moins un élément de déplacement (348) fixé d'une manière flexible audit moyen pousoir de telle sorte que ledit élément de déplacement vienne en prise avec ledit moyen d'engagement (396) pendant l'application des attaches chirurgicales et se dégage dudit moyen d'engagement pendant la découpe du tissu excédentaire.
3. Instrument chirurgical selon la revendication 2, où ledit moyen d'engagement comporte un évidement (396) dans ledit ensemble de couteau (350) et où ladite portion de châssis comporte une chambre à son extrémité distale avec une partie de zone agrandie (368) et une partie de zone diminuée (370) proximale relativement à ladite partie de zone agrandie, au moins un élément de déplacement précité étant sollicité élastiquement au loin dudit évidement de telle sorte que lorsqu'au moins un élément de déplacement précité et ledit évidement se trouvent dans ladite partie de zone diminuée de ladite portion de châssis, ledit élément de déplacement est sollicité en prise avec ledit évidement en mettant ainsi en prise ledit moyen pousoir avec ledit moyen de découpe, et lorsqu'au moins un élément de déplacement précité et ledit évidement sont avancés dans ladite partie de zone agrandie de ladite portion de châssis, au moins un élément de déplacement précité est amené à sortir de prise avec ledit évidement en sortant ainsi ledit moyen pousoir dudit moyen de découpe.
4. Instrument chirurgical selon la revendication 3, où les attaches chirurgicales (52, 72, 94) comportent au moins une première bague (94) et une deuxième bague (72) pour fixer les première et deuxième sections de tissu entre celles-ci.
5. Instrument chirurgical selon la revendication 4, où ledit moyen de rétraction comporte:
  - a) un moyen de support (414) situé distalement relativement à ladite portion de châssis pour tenir ladite première bague;
  - b) un élément de queue (418) monté à rotation à une extrémité proximale de ladite portion de châssis; et
  - c) un ensemble de transmission de rétraction (98) fixé à une extrémité distale audit moyen de support et pouvant être mis en prise à une extrémité proximale avec ledit élément de queue de telle sorte que la rotation dudit élément de queue provoque un déplacement axial dudit ensemble de transmission de rétraction et ainsi dudit moyen de support;
 

où ledit moyen pousoir comporte un élément pousoir (346) comportant un rebord circonférentiel (386) apte à supporter ladite deuxième bague (72) pendant la découpe des première et deuxième sections de tissu après la fixation, par quoi

    - a) la rotation dudit élément de queue (418) tire ladite première bague (94) proximalement au voisinage de ladite portion de châssis réunissant les première et deuxième sections de tissu entre celles-ci;

- b) un mouvement distal initial dudit ensemble de couteau à travers ladite portion de châssis permet audit élément de déplacement (348) de venir en prise avec ledit moyen d'engagement en déplaçant ainsi ledit élément pousoir à travers ladite portion de châssis en entraînant ladite deuxième bague en une relation de fixation avec ladite première bague en capturant ainsi les première et deuxième sections de tissu entre celles-ci; et 5  
 10
- c) une poursuite du mouvement distal dudit ensemble de couteau à travers ladite portion de châssis permet auxdits éléments de déplacement de sortir de prise avec ledit moyen d'engagement dudit ensemble de couteau en permettant ainsi audit ensemble de couteau d'avancer distalement indépendamment dudit élément de pousoir en découplant ainsi le tissu excédentaire capturé entre ladite première bague et ladite deuxième bague. 15  
 20
6. Instrument chirurgical selon la revendication 5, où une partie la plus distale de ladite zone agrandie de ladite portion de châssis est apte à supporter une troisième bague (52) de telle sorte que la rotation dudit élément de queue tire ladite première bague sur ladite troisième bague pour réunir les première et deuxième sections de tissu entre celles-ci et que l'avance dudit élément pousoir contraint ladite deuxième bague (72) en une prise de verrouillage avec ladite troisième bague en attachant ainsi les première et deuxième sections de tissu. 25  
 30
7. Instrument chirurgical selon l'une des revendications 1 à 6, comportant en outre un élément de ressort (332) pour solliciter ledit élément de lame en une position la plus proximale. 35
8. Instrument chirurgical selon l'une des revendications précédentes, où ladite portion de châssis et ledit moyen de rétraction définissent conjointement un percage (482) s'étendant axialement sur toute la longueur de l'instrument et apte à recevoir des instruments accessoires à travers celui-ci. 40  
 45
9. Instrument chirurgical selon l'une des revendications précédentes, comportant en outre un moyen de verrouillage (456) associé à ladite portion de châssis pour bloquer un déplacement dudit moyen de découpe jusqu'à ce que la première section de tissu et la deuxième section de tissu soient sensiblement réunies par ledit moyen de rétraction. 50
10. Instrument chirurgical selon l'une des revendications précédentes, comportant en outre un moyen d'évacuation (359) pour permettre l'échappement d'une pression d'air excédentaire entre les première et deuxième sections de tissu réunies et de l'intérieur de l'instrument. 55

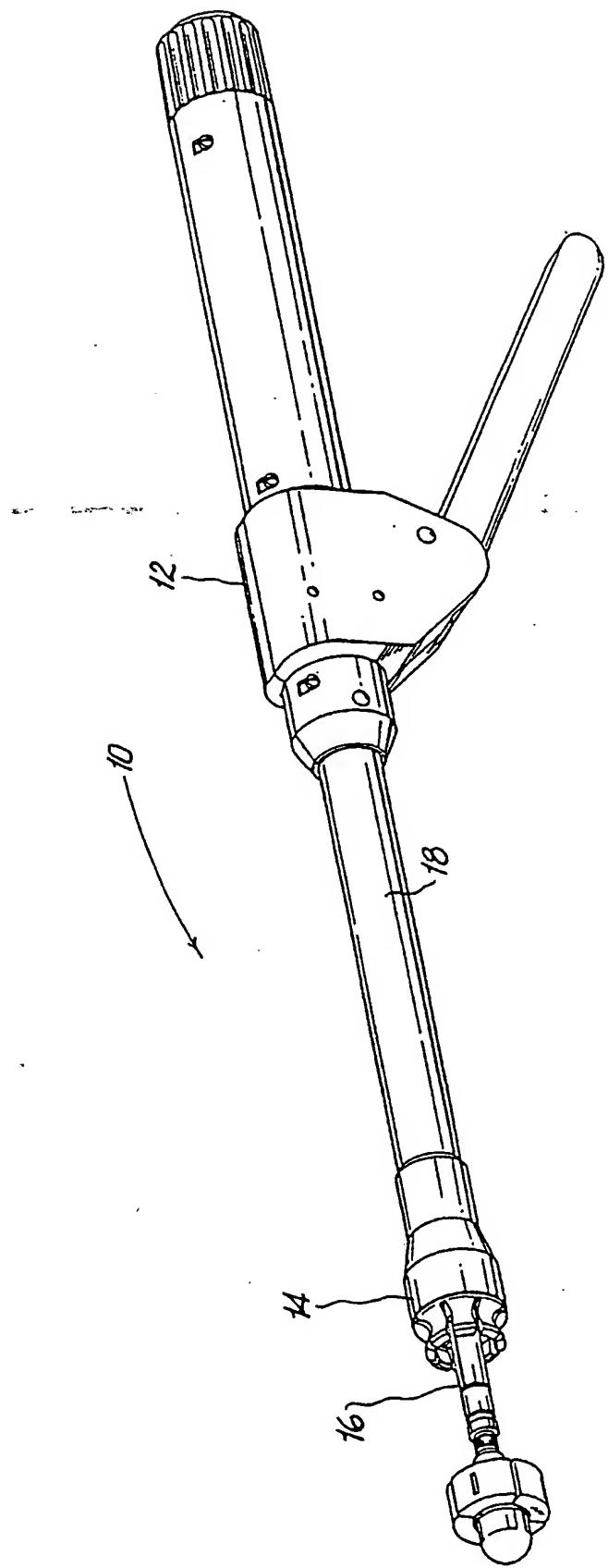


FIG. 1

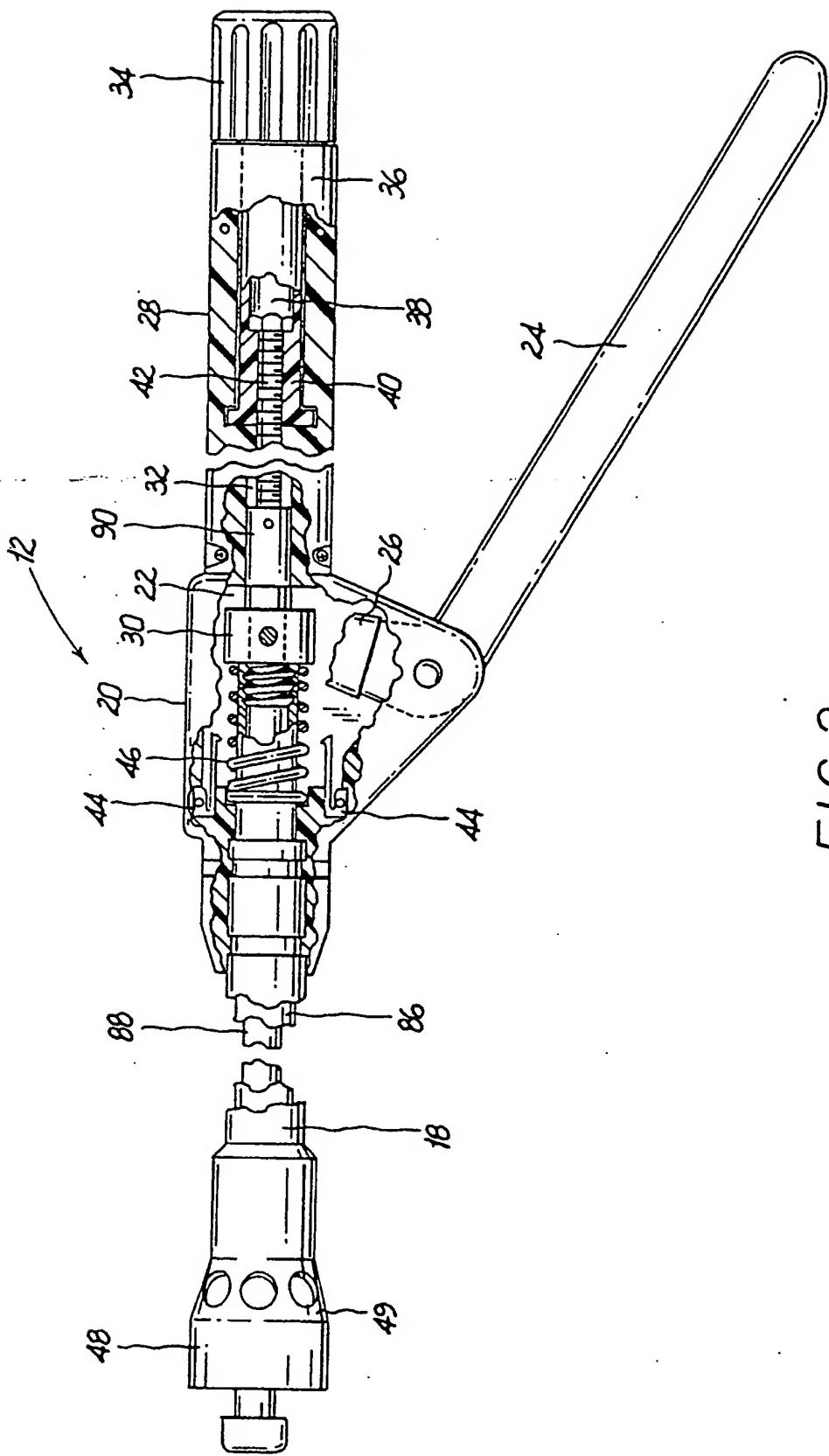
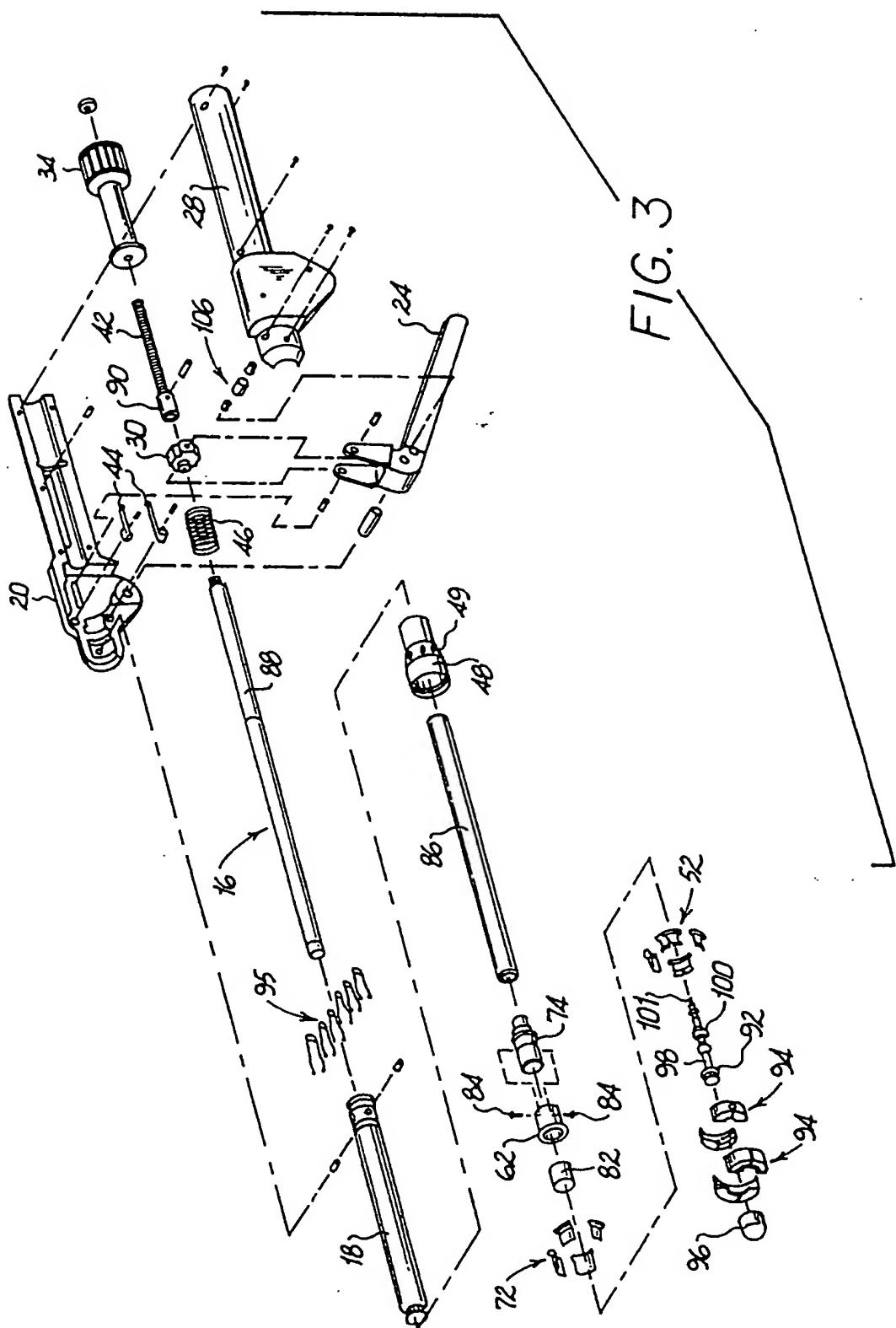


FIG. 2



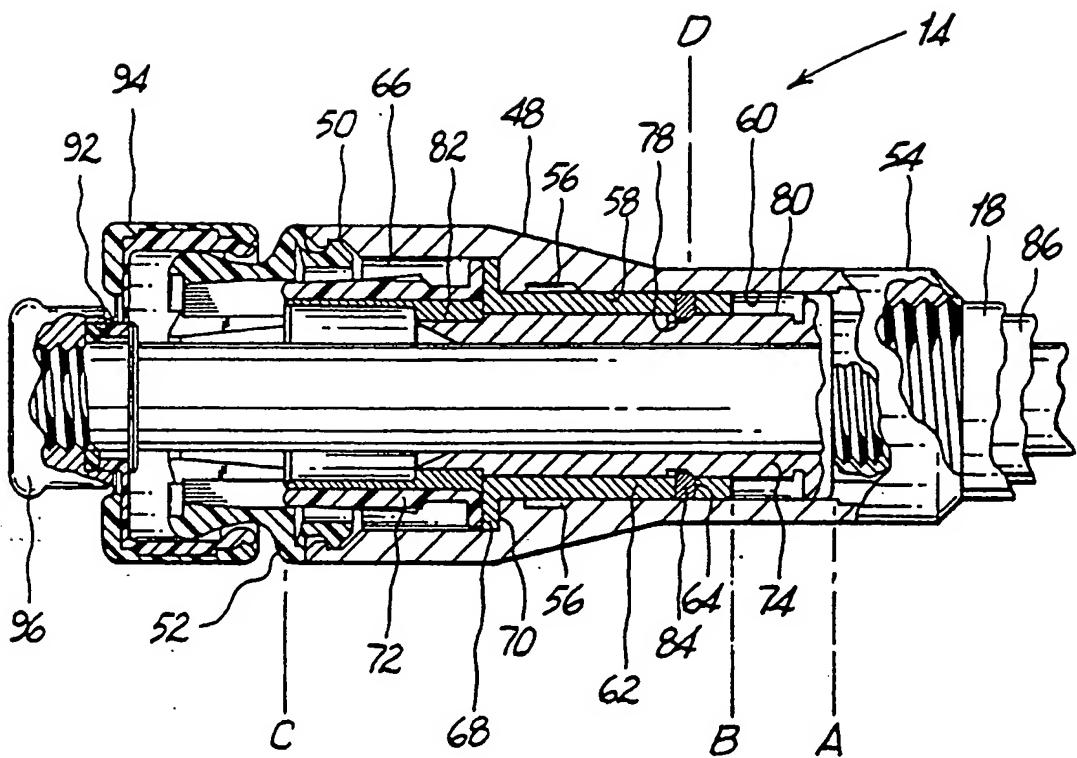


FIG. 4

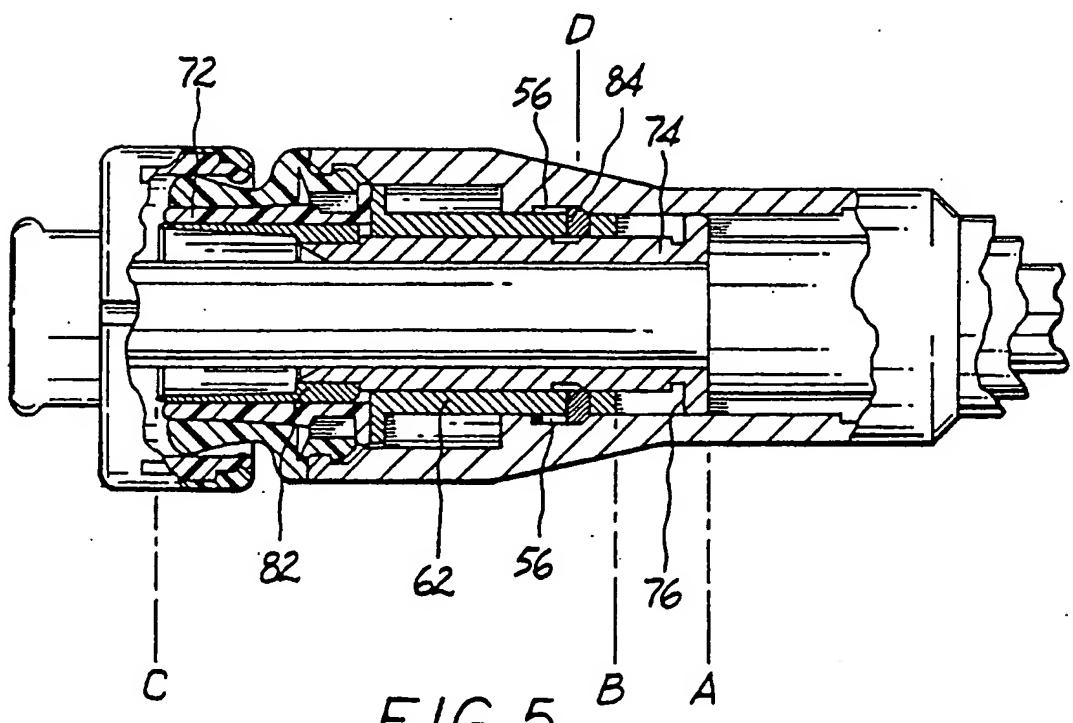


FIG. 5

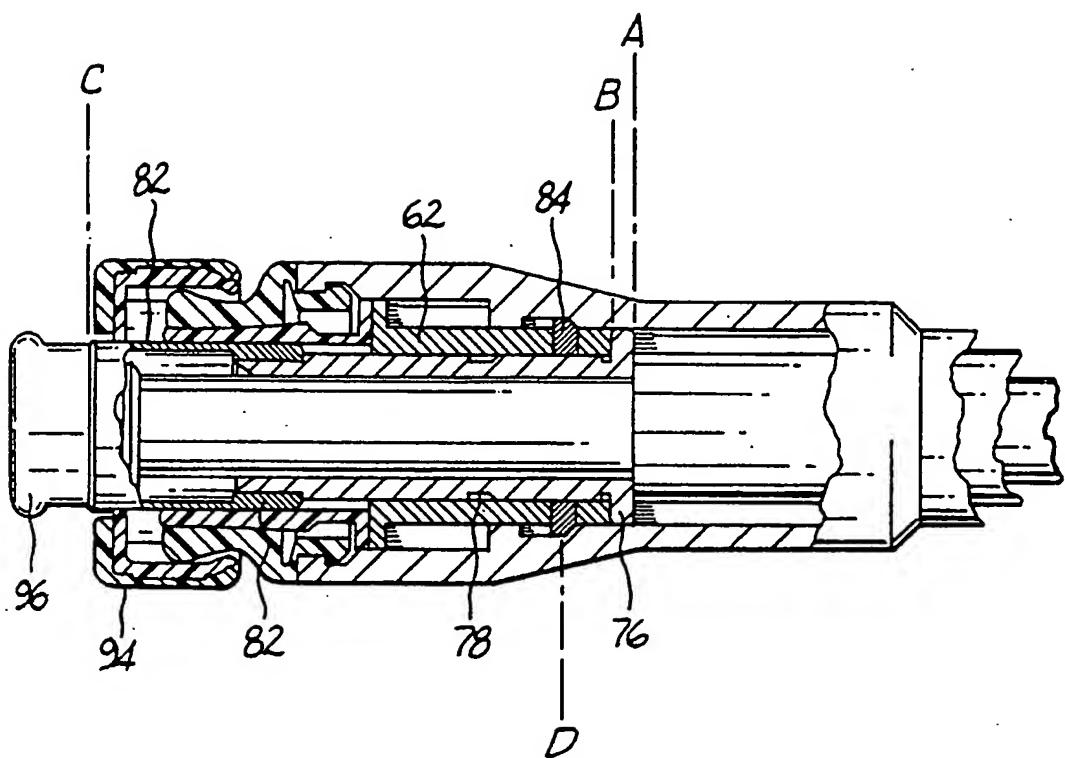


FIG. 6

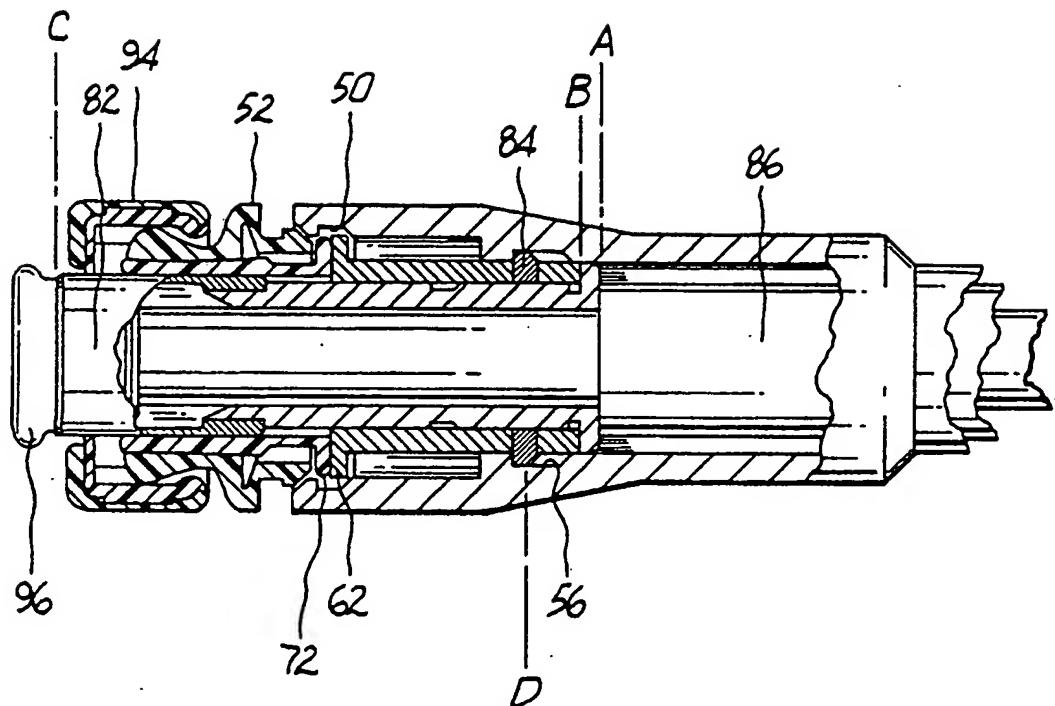


FIG. 7



FIG. 8a

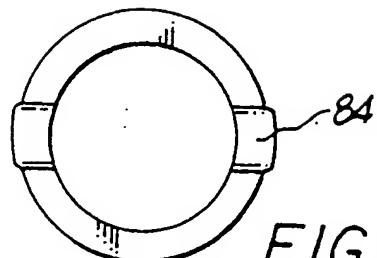


FIG. 8b

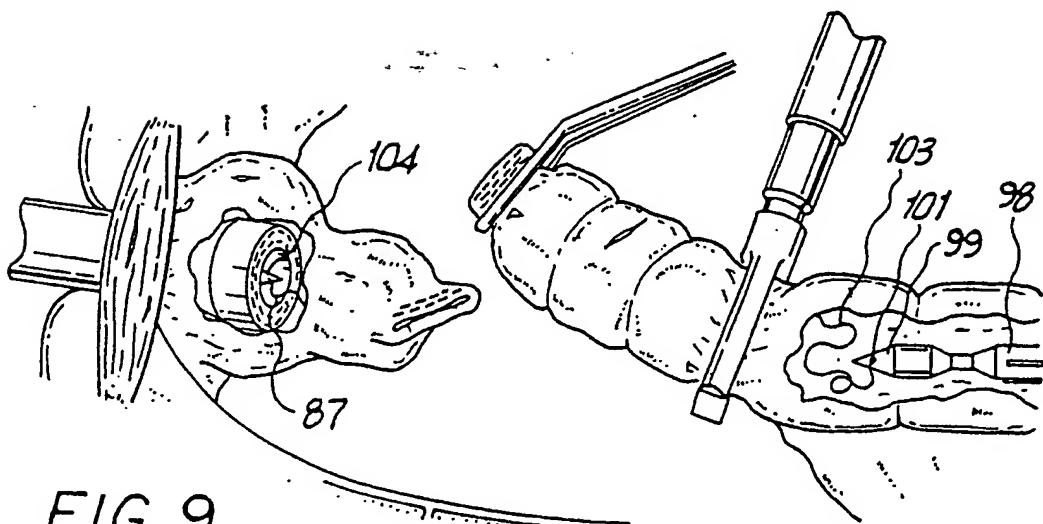


FIG. 9

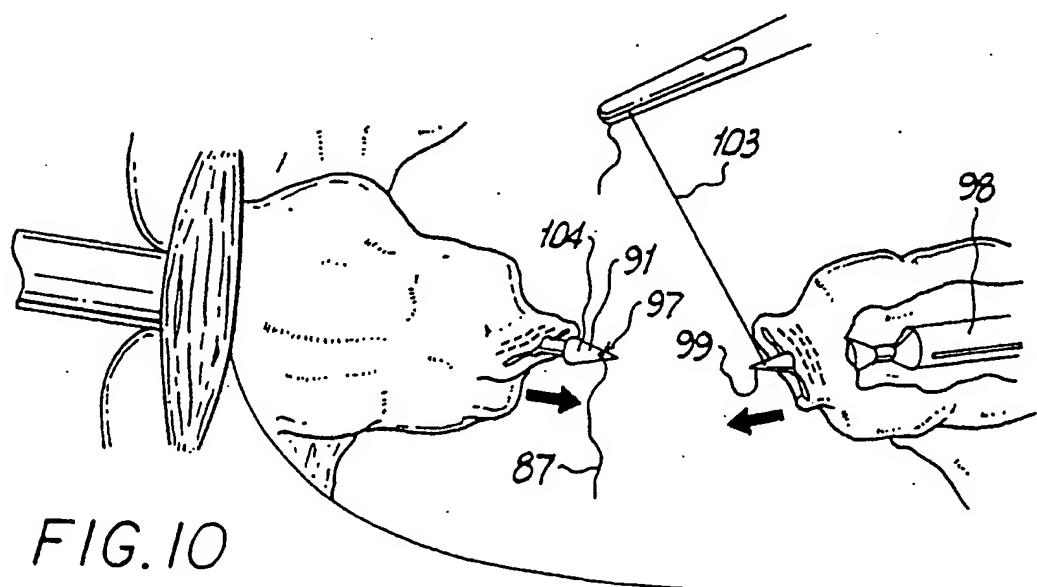


FIG. 10

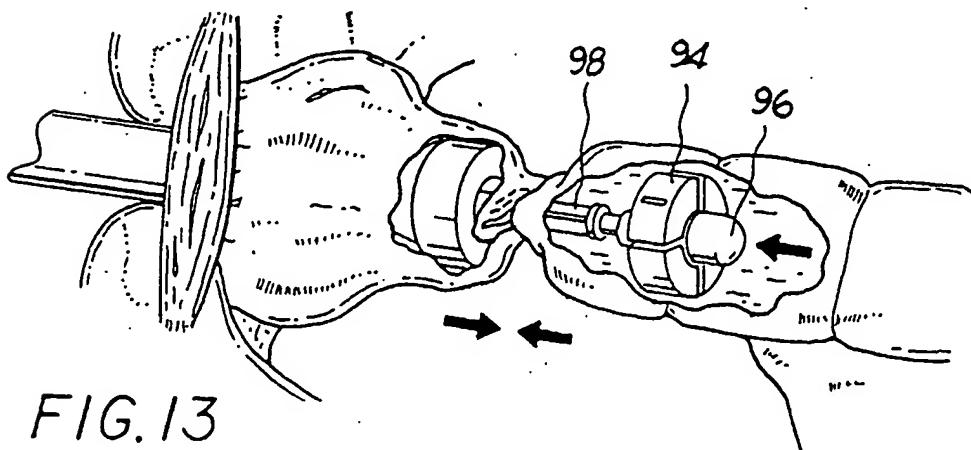
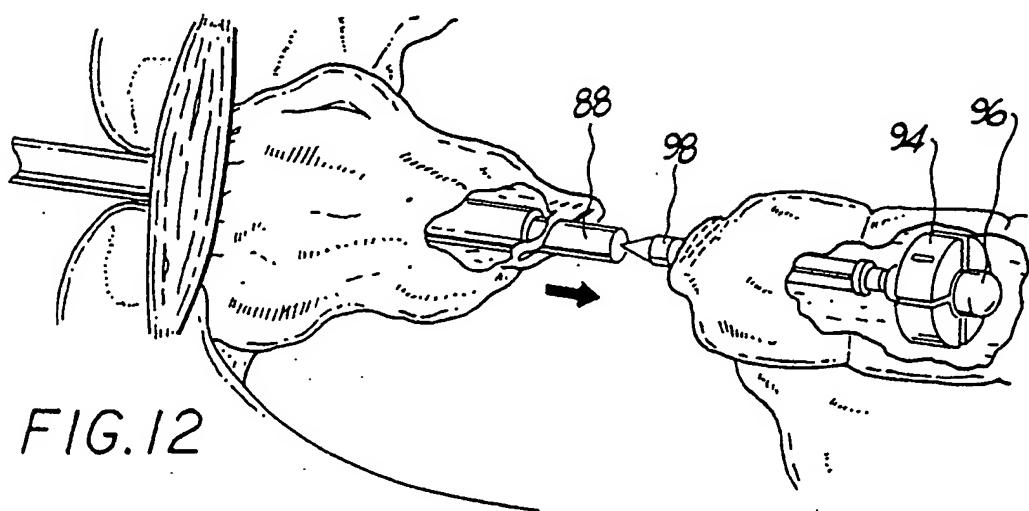
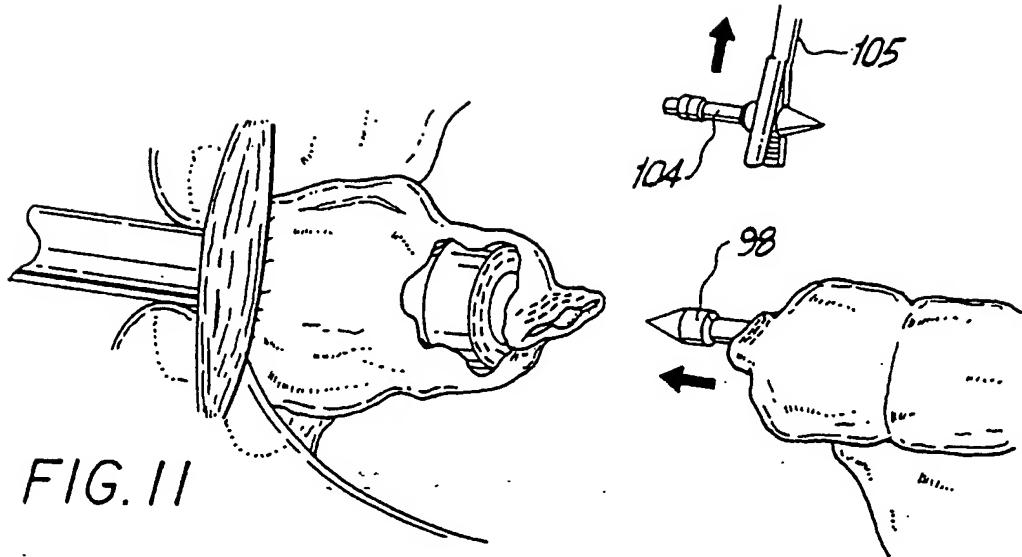


FIG.14a

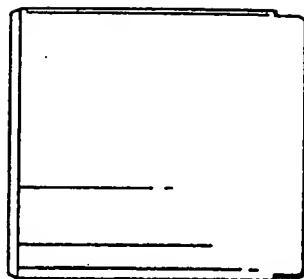
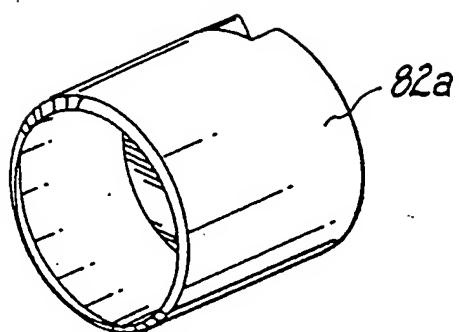


FIG.14aa

FIG.14c

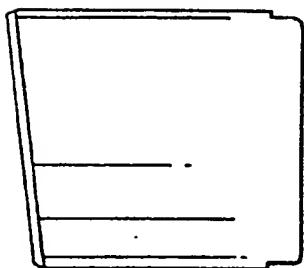
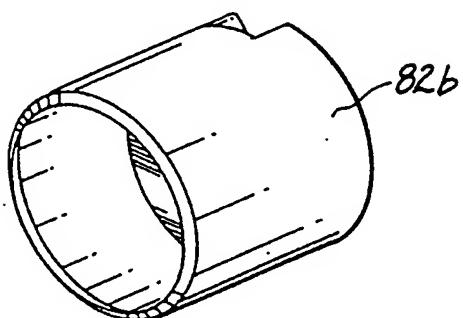


FIG.14cc

FIG.14b

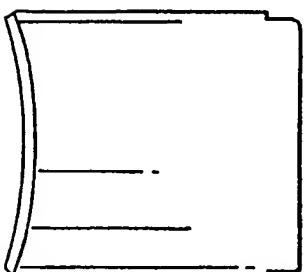
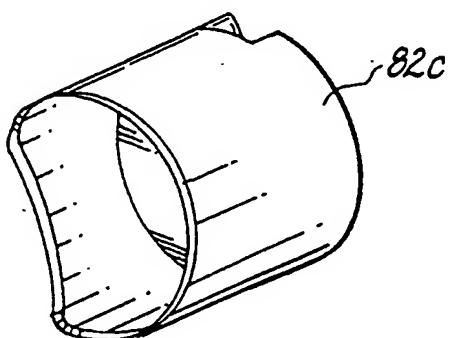


FIG.14bb

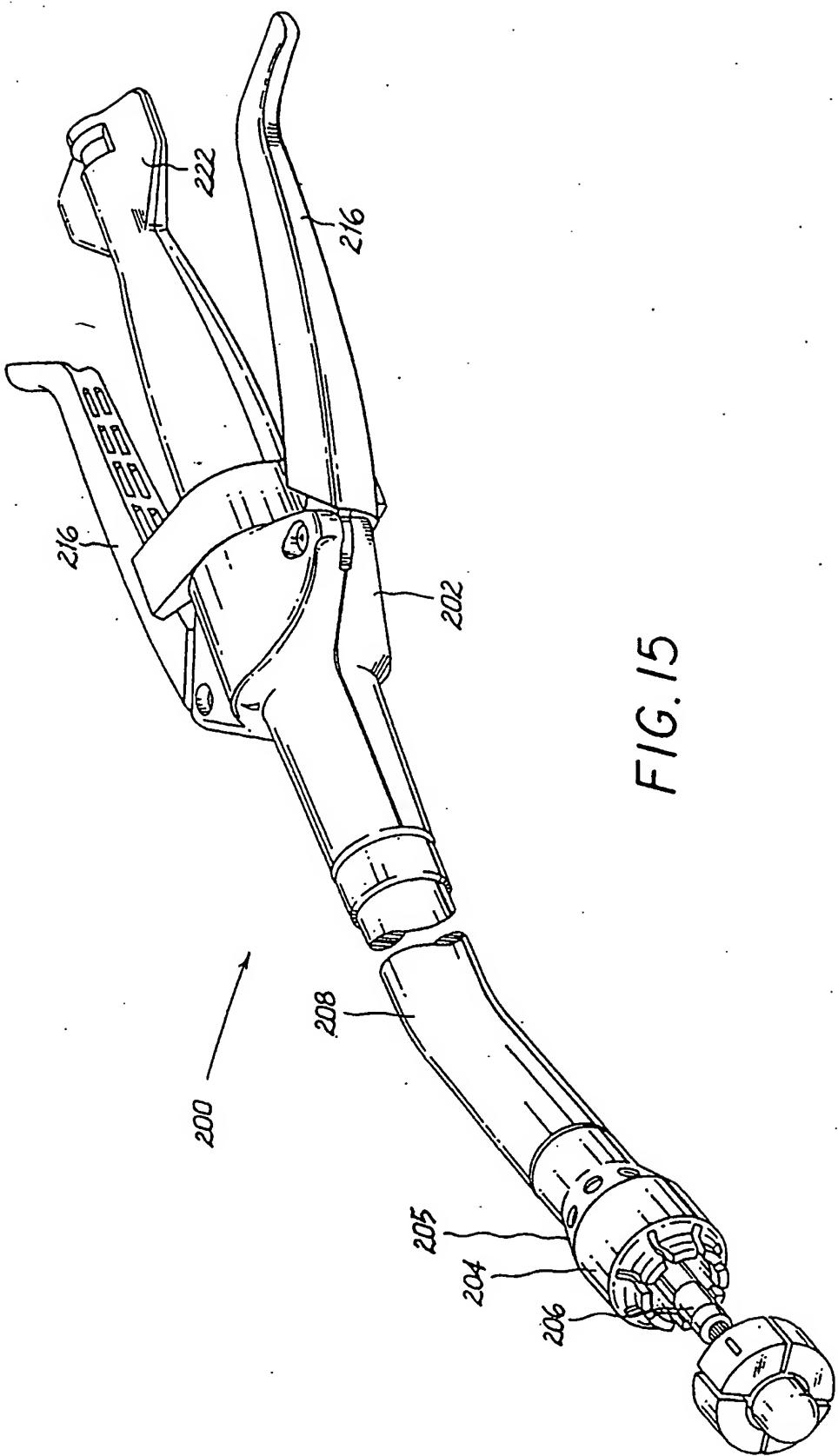


FIG. 15

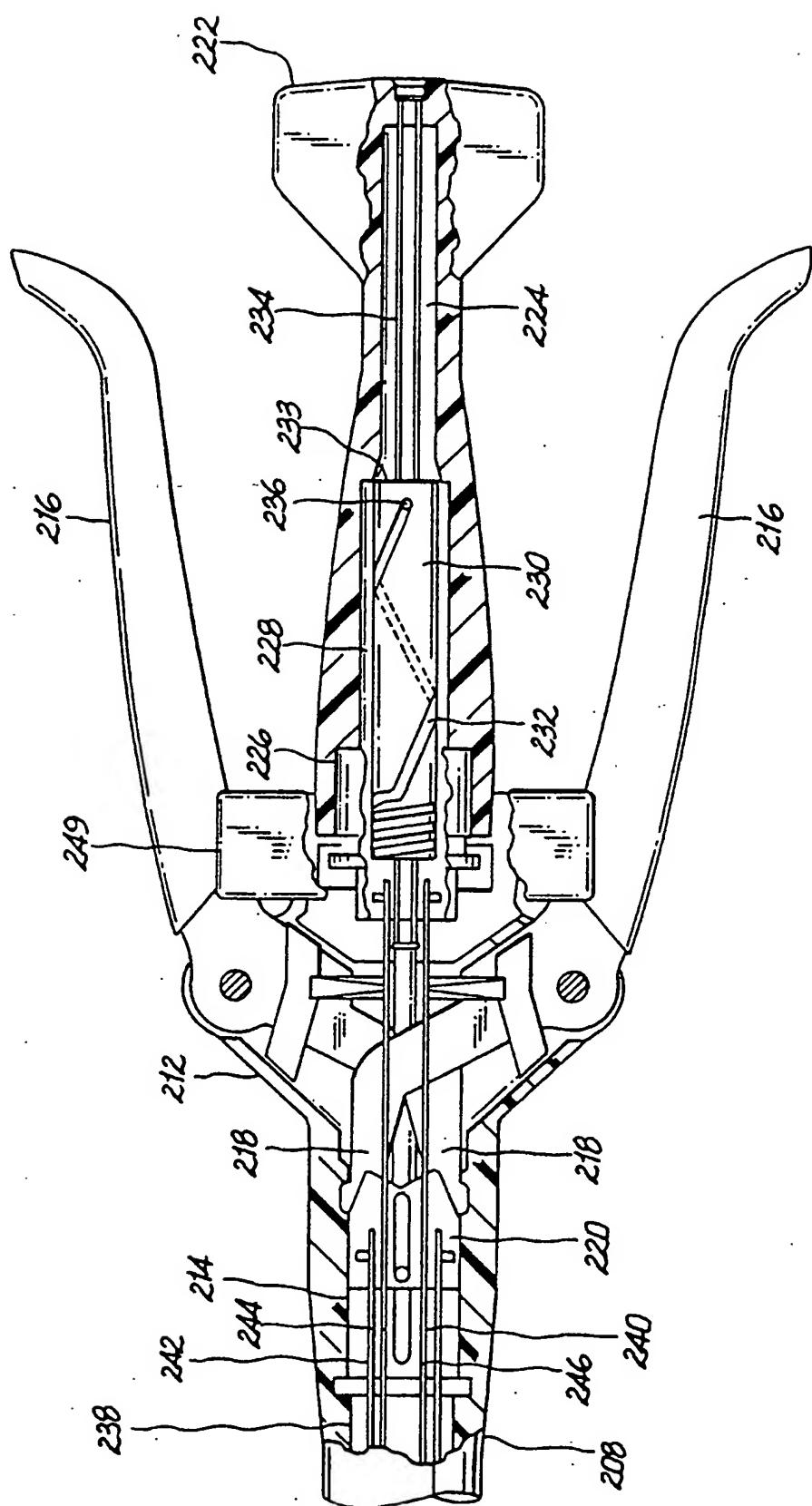


FIG. 16

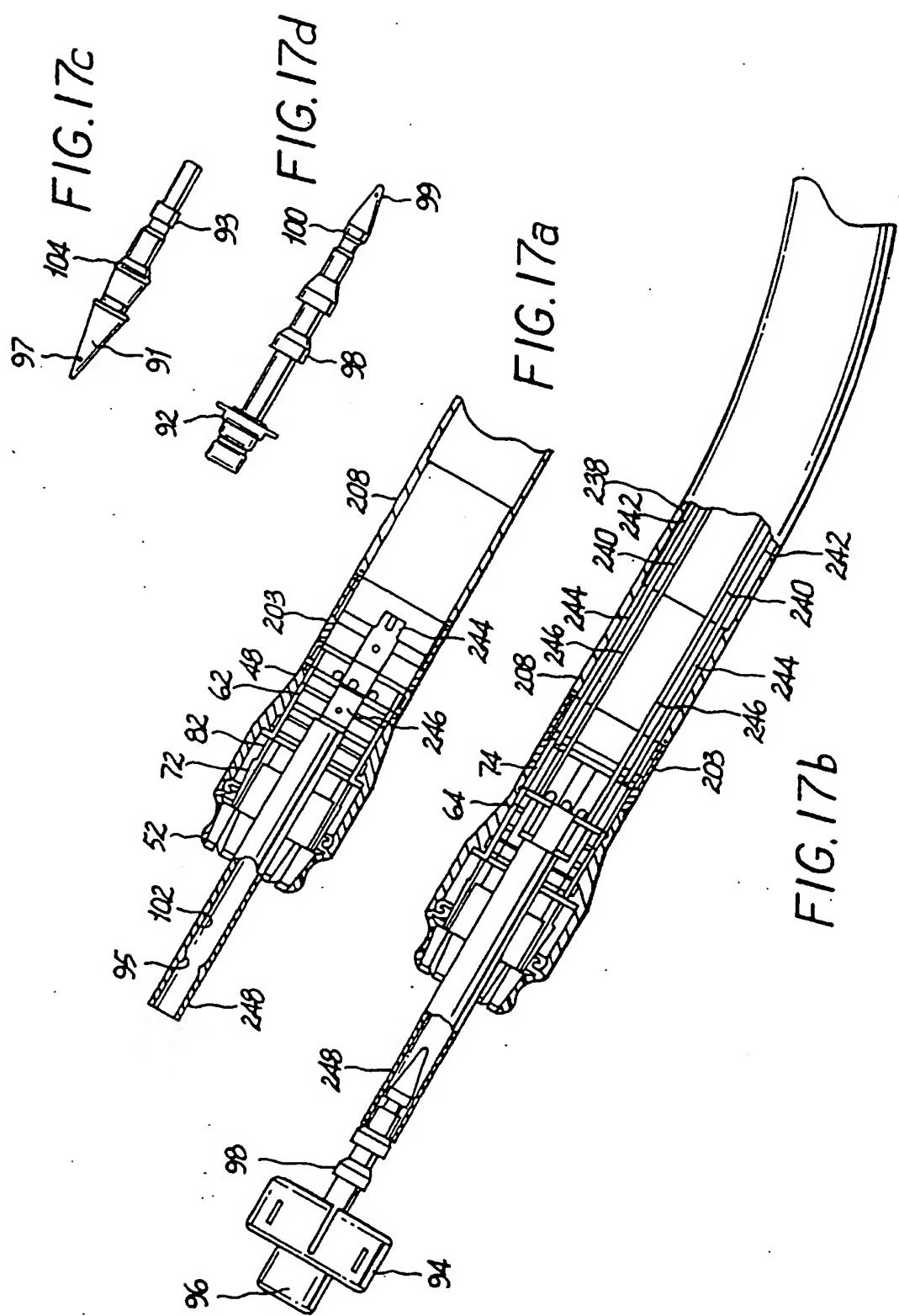


FIG. 18c

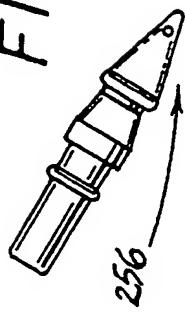


FIG. 18d

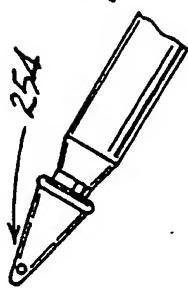


FIG. 18a

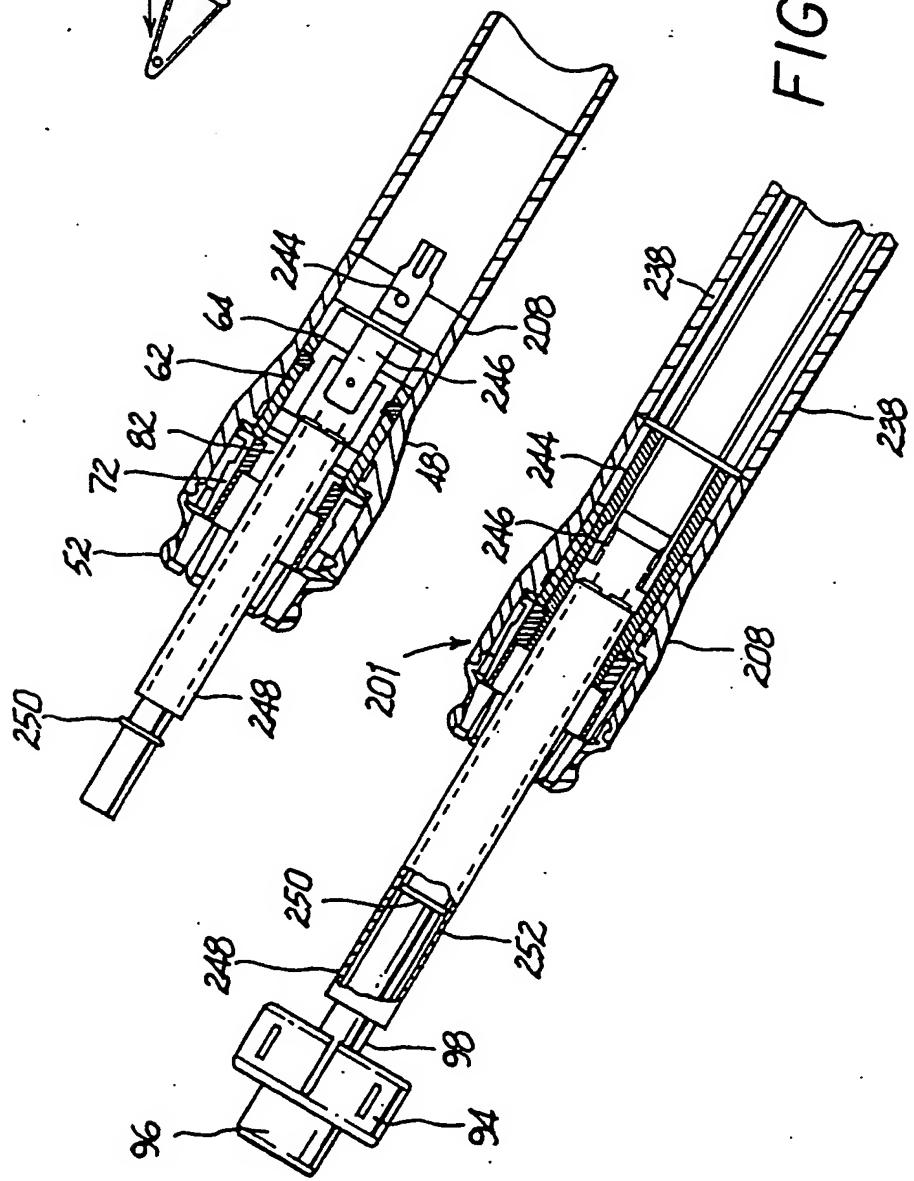


FIG. 18b

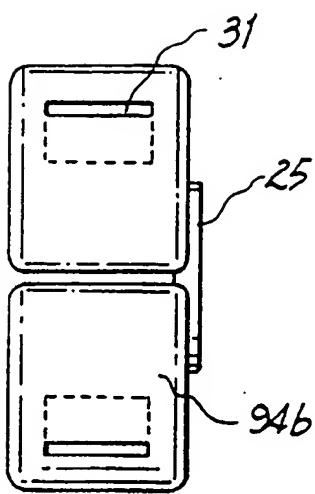


FIG. 19a

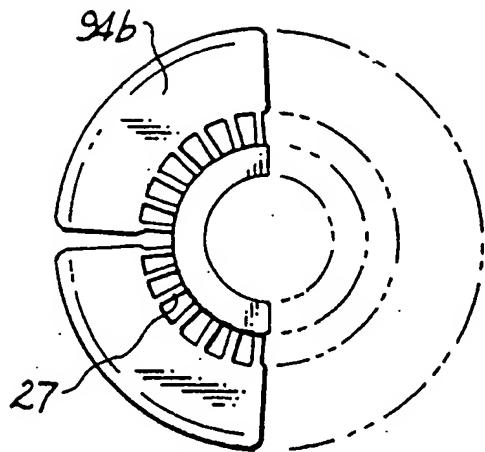


FIG. 19b

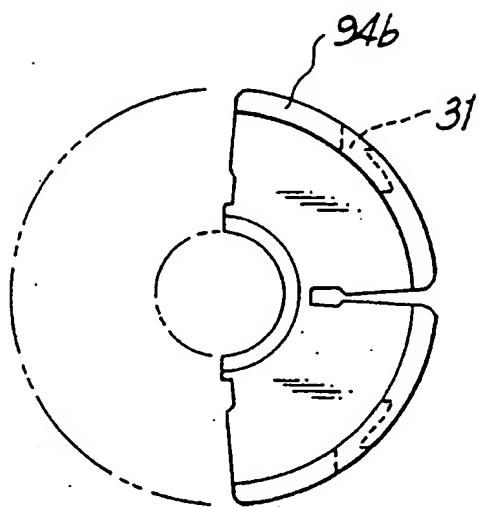


FIG. 19c

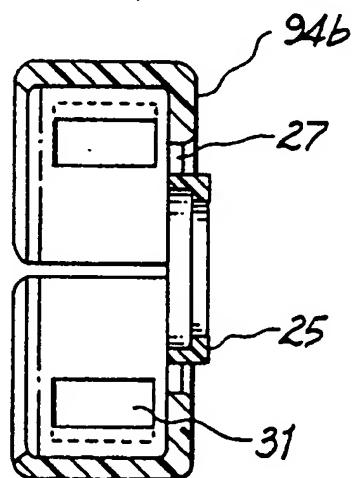


FIG. 19d

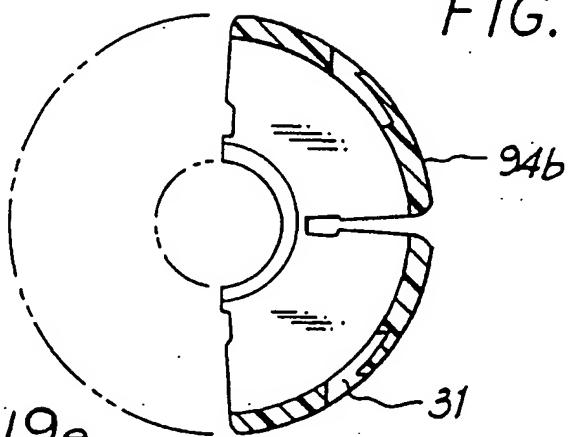


FIG. 19e

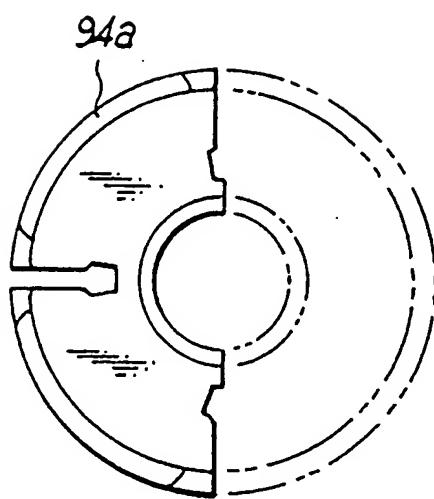


FIG. 20a

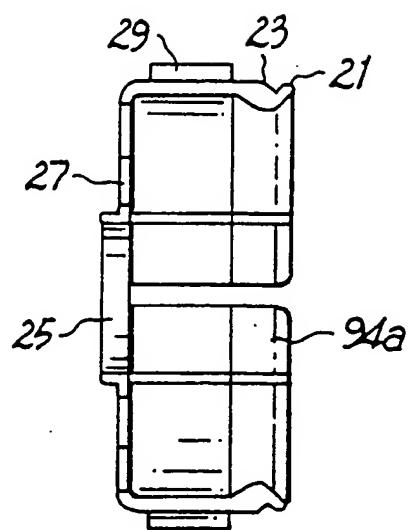


FIG. 20b

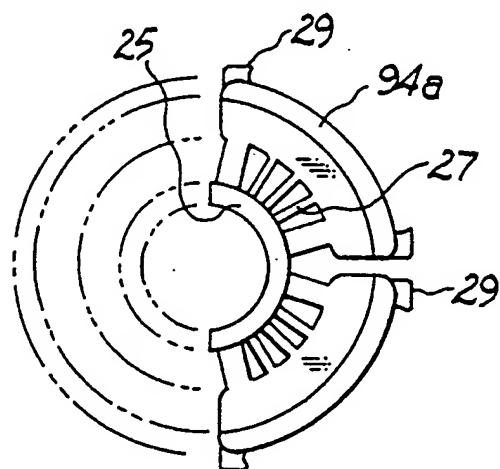


FIG. 20c

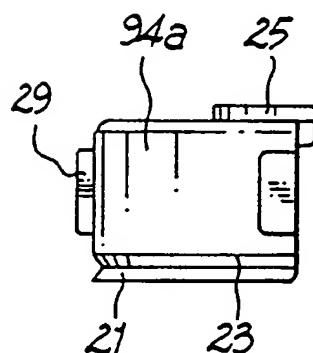


FIG. 20d

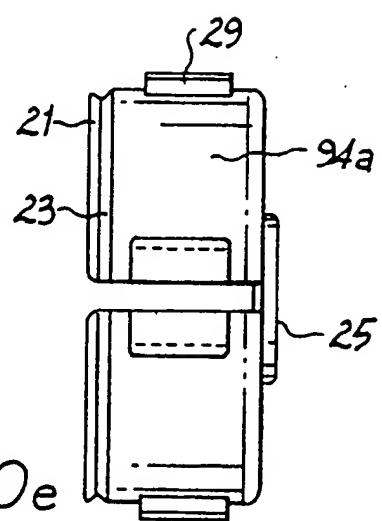


FIG. 20e

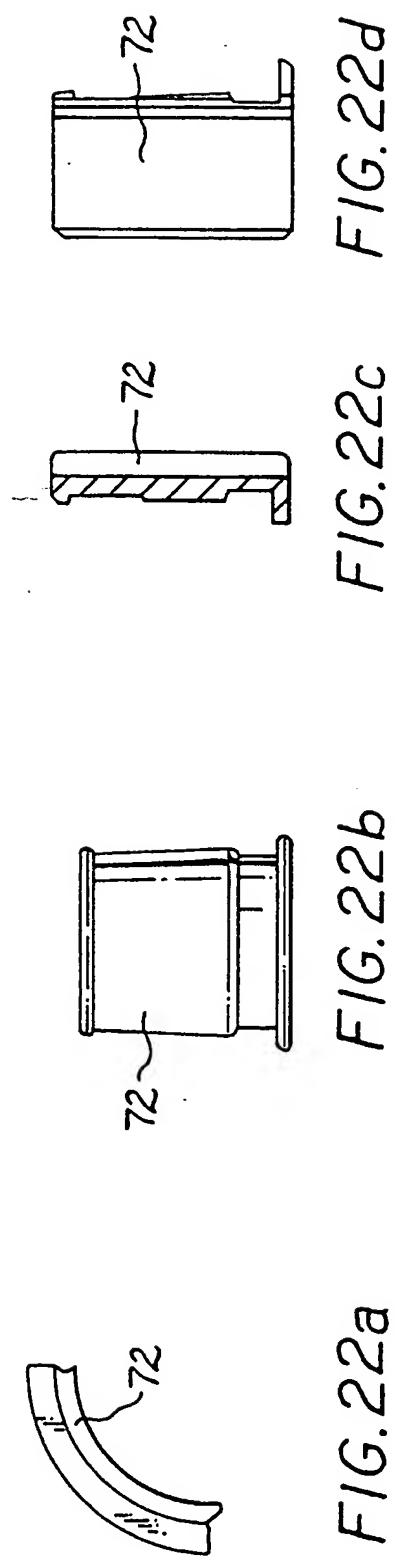
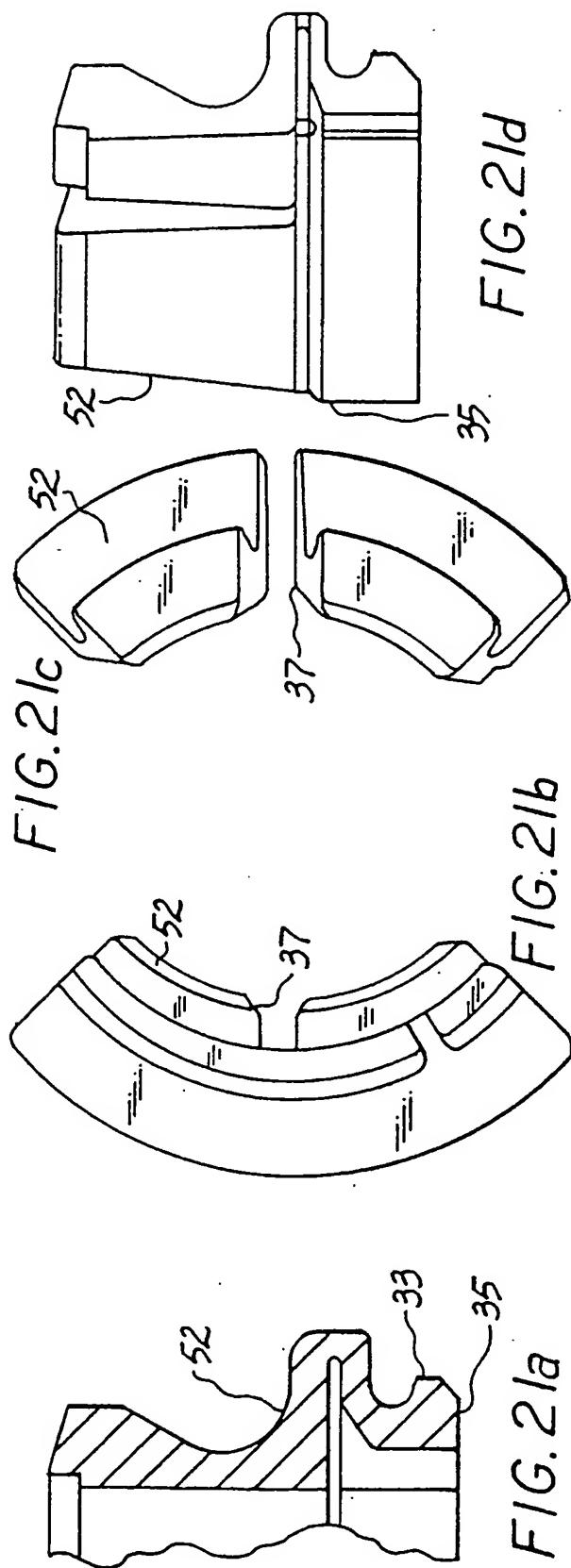
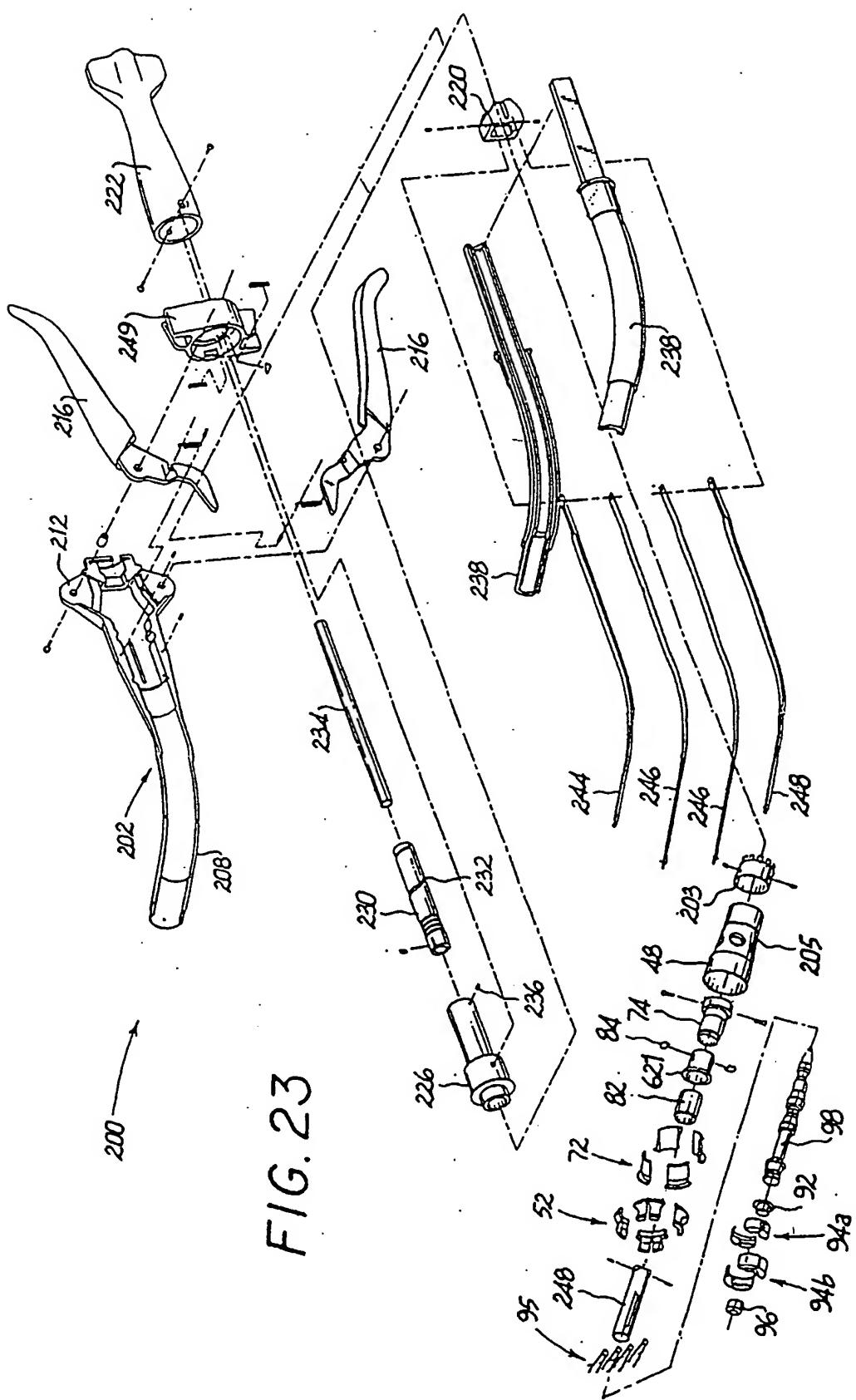


FIG. 23



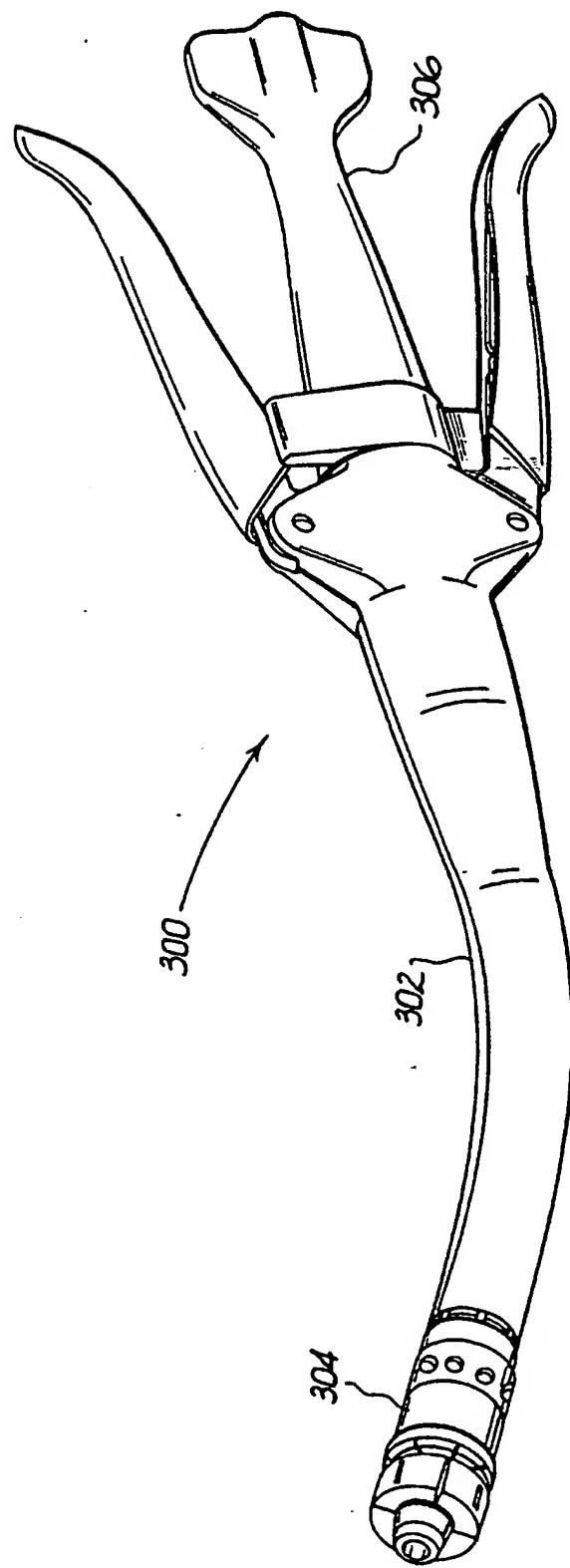
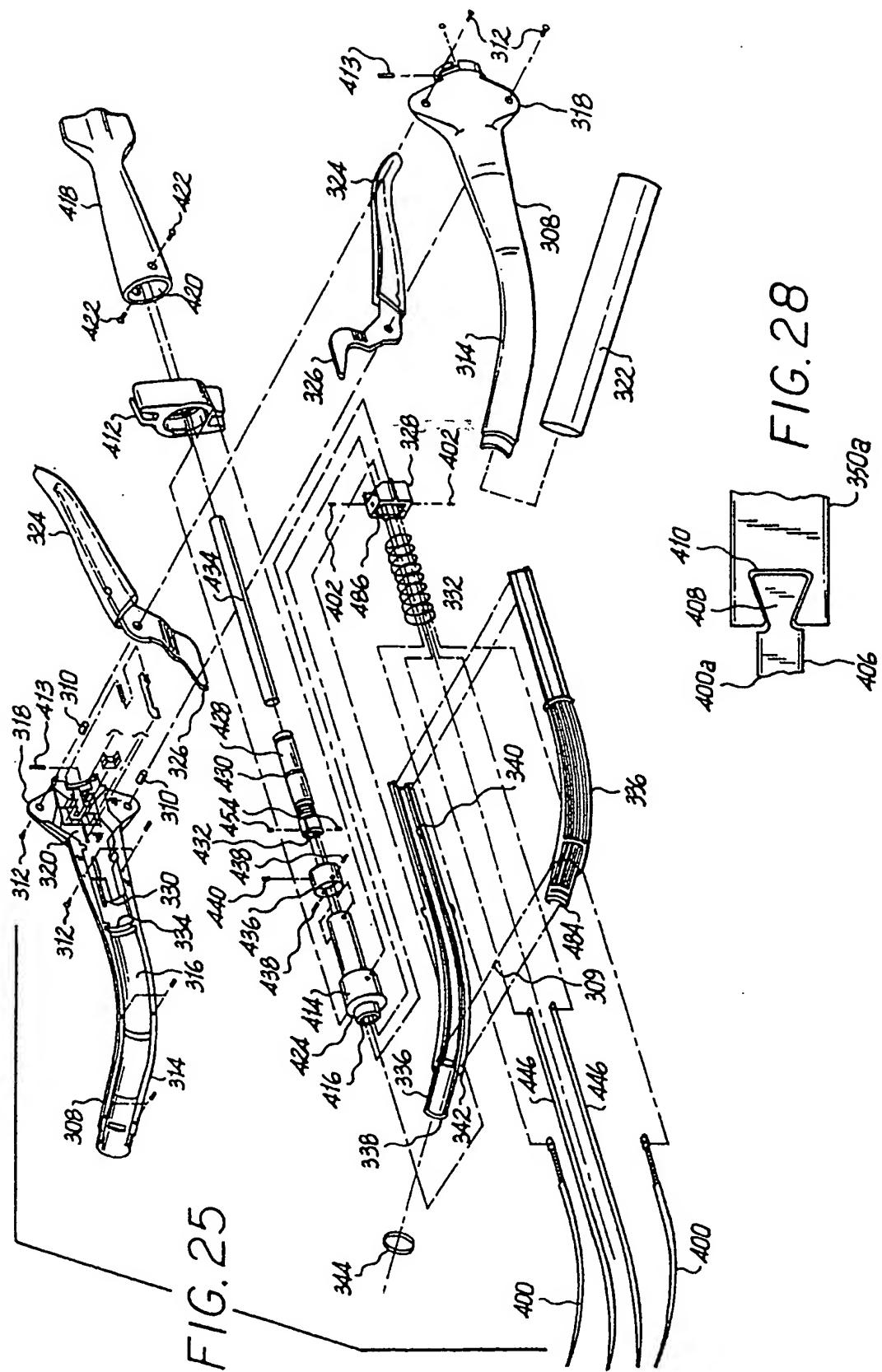


FIG. 24



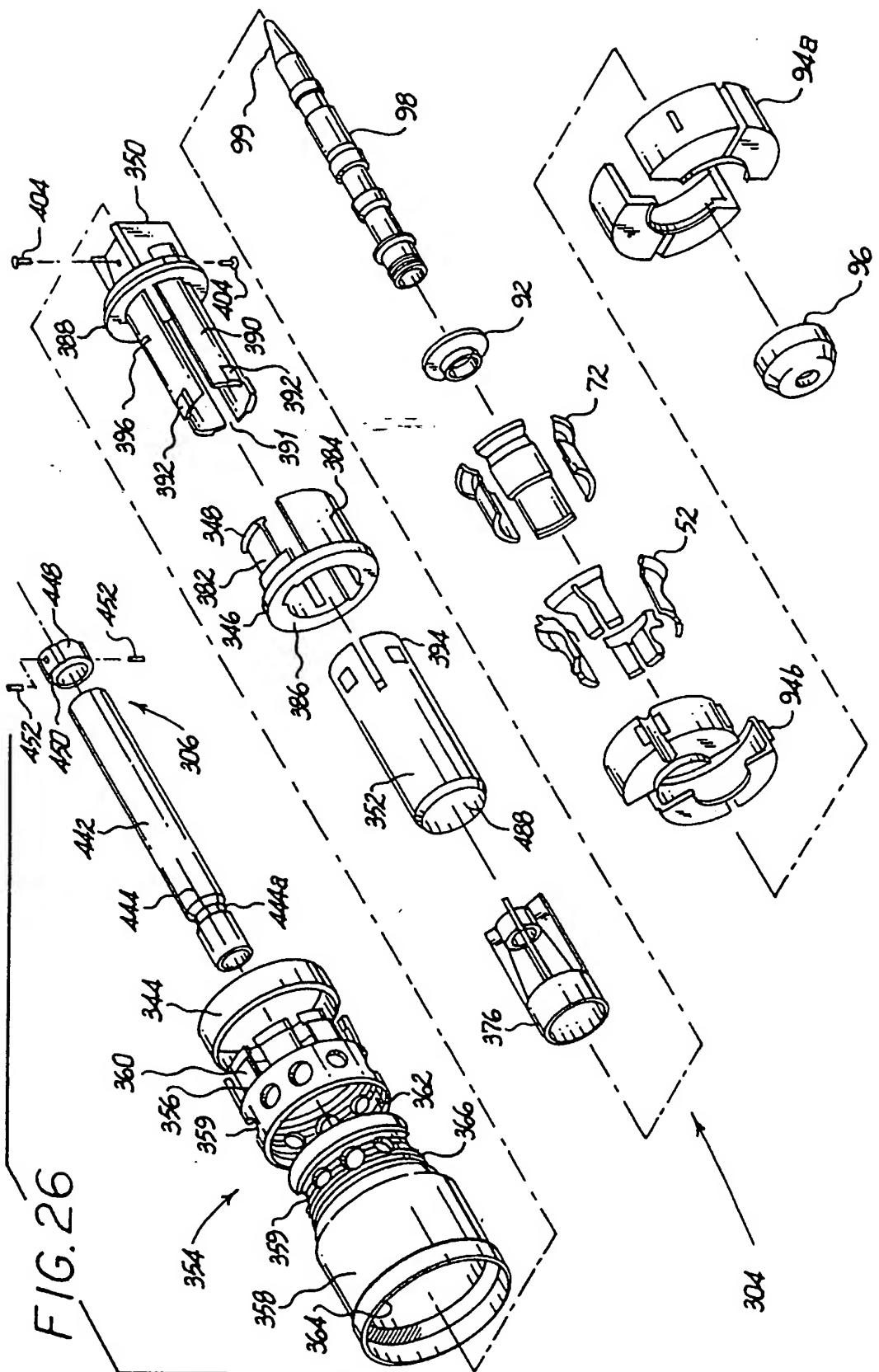


FIG. 27

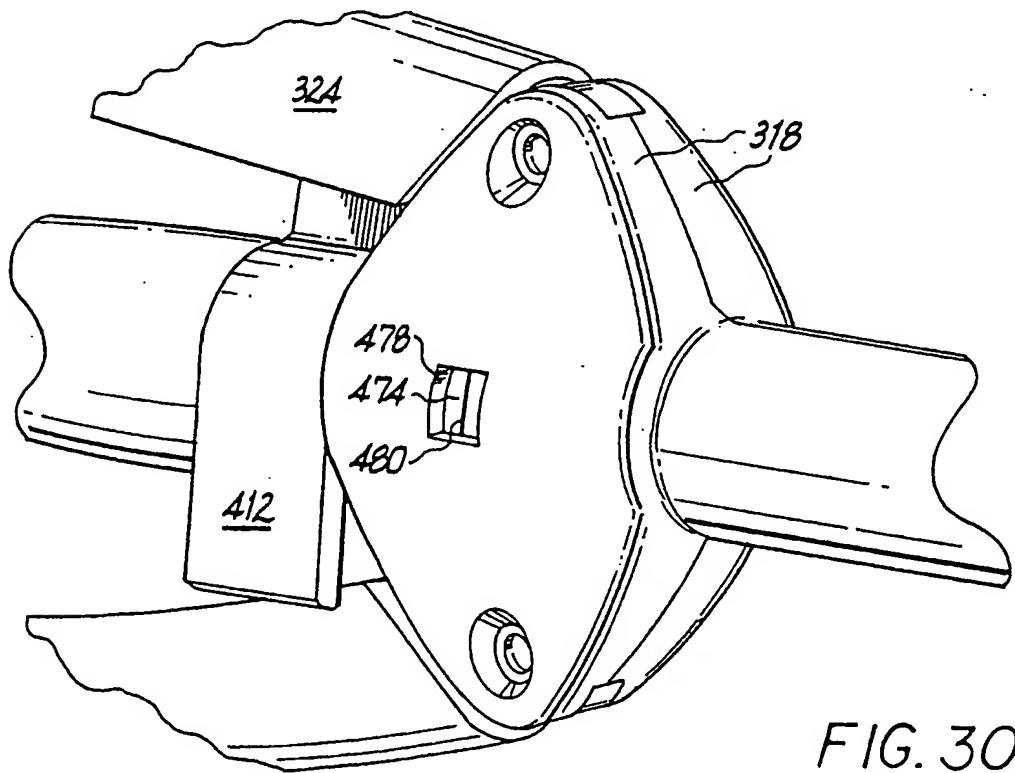
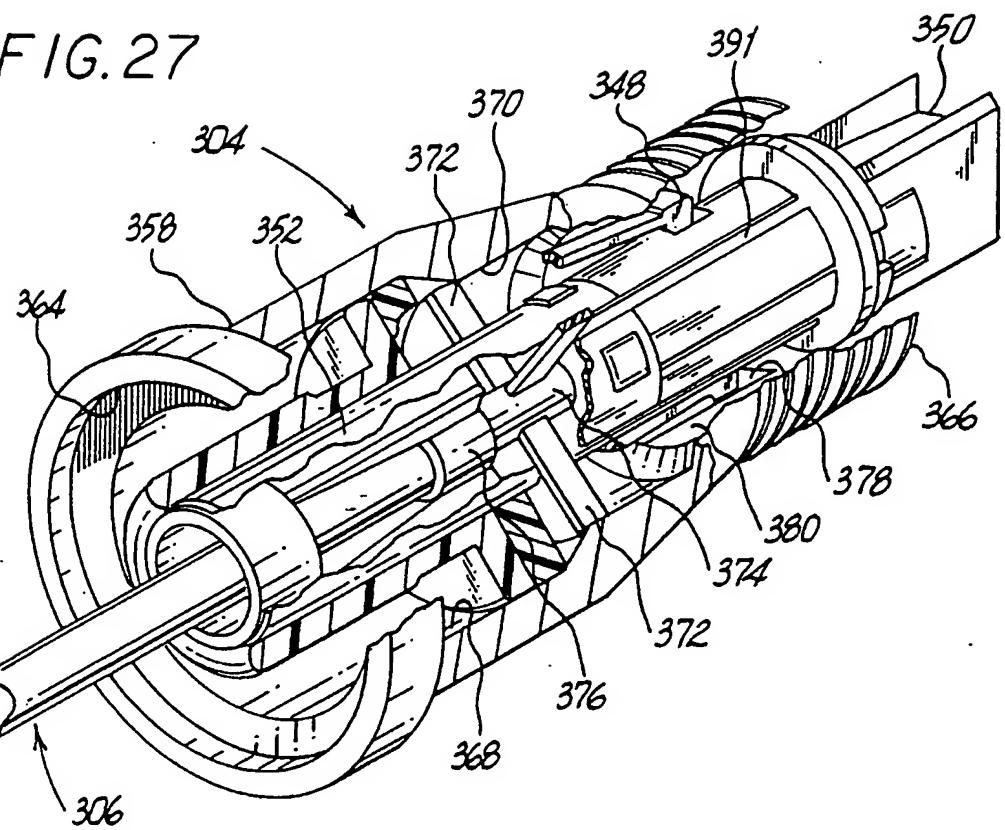
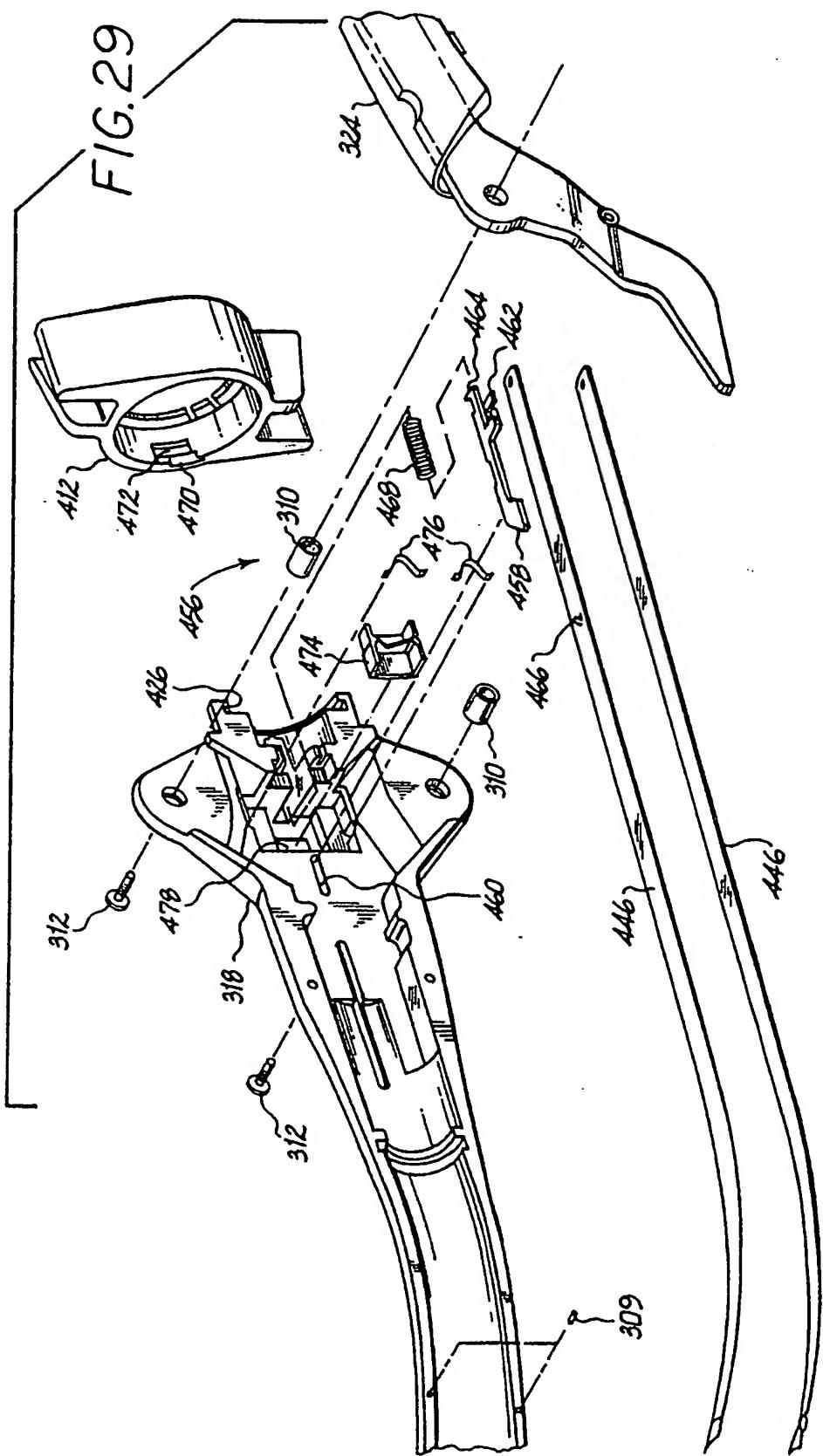


FIG. 30



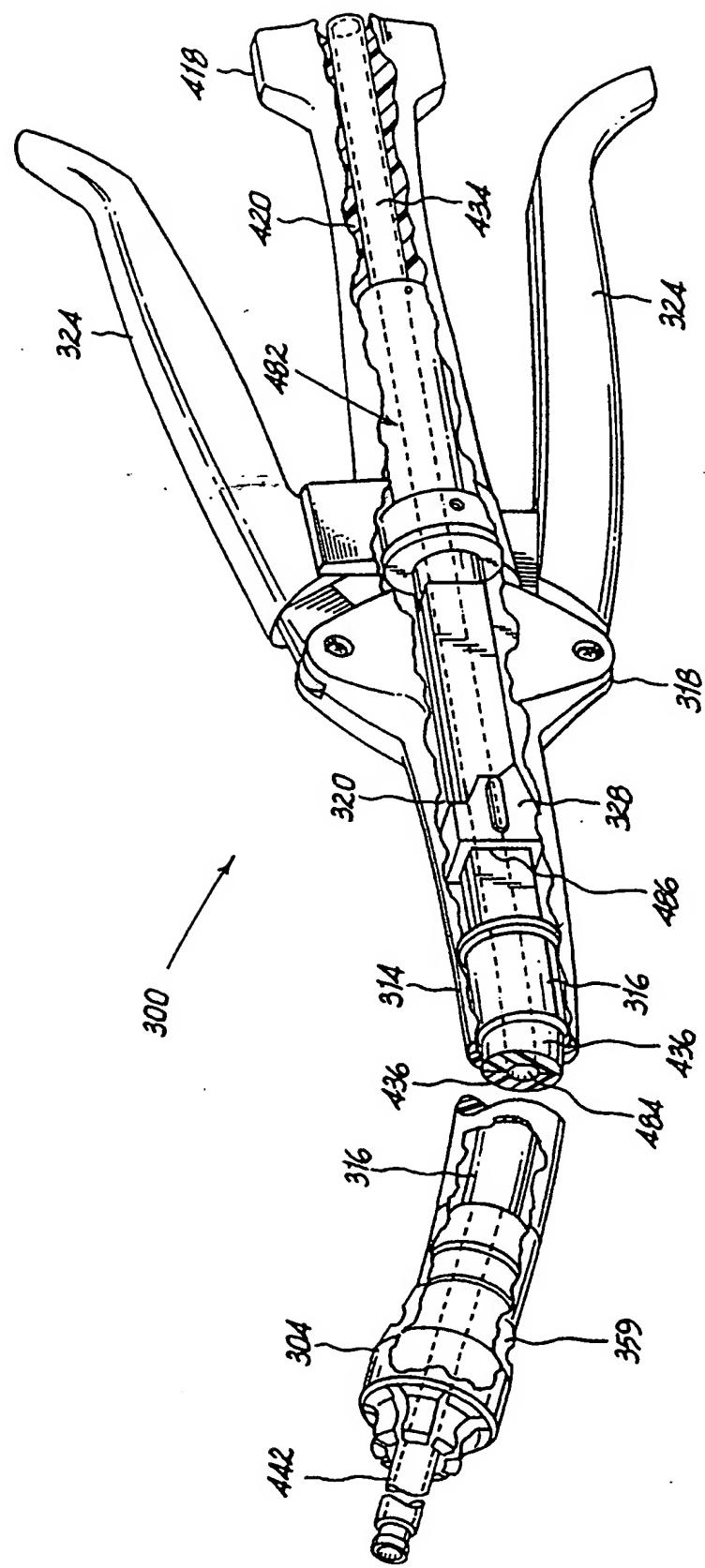
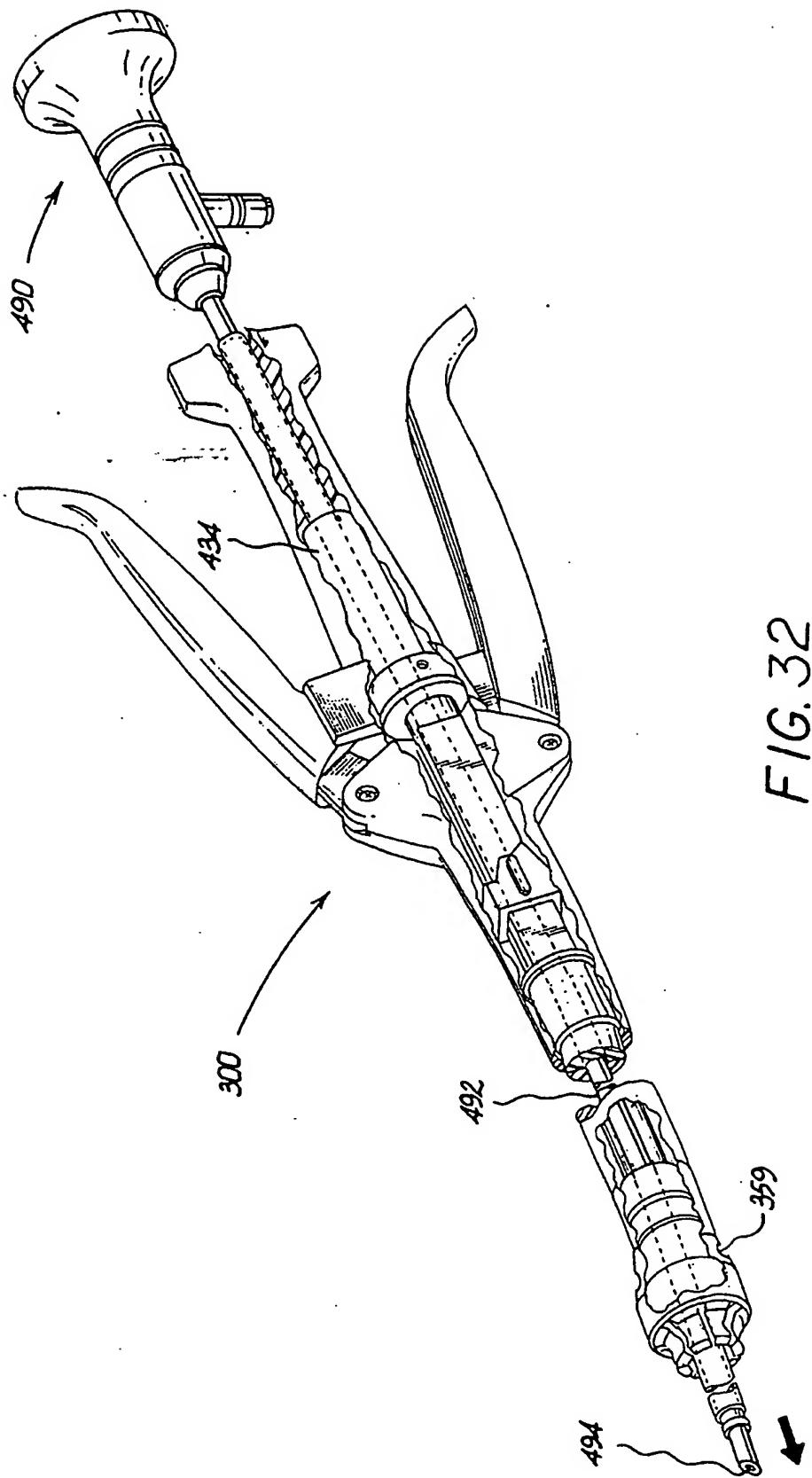


FIG. 31



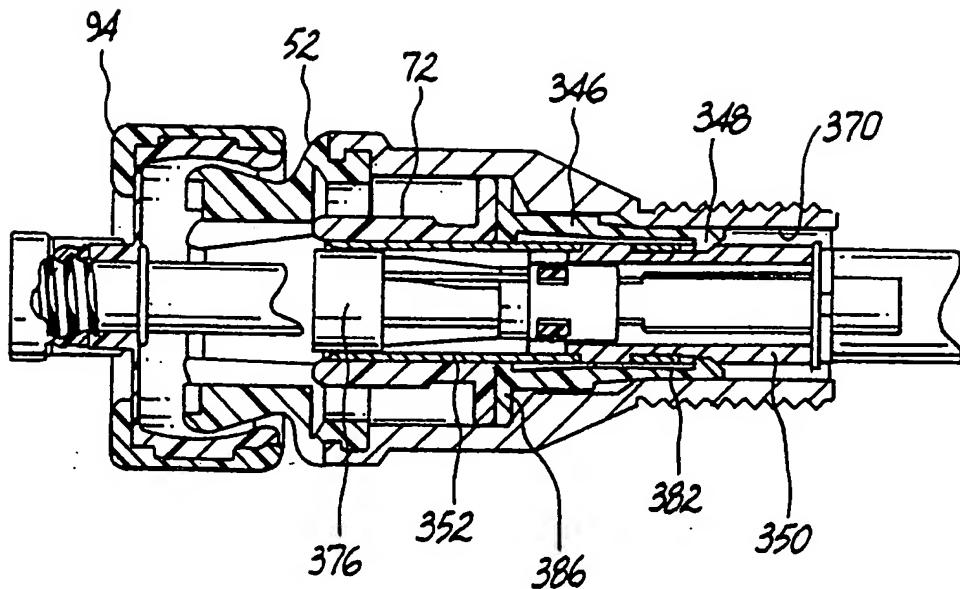


FIG. 33

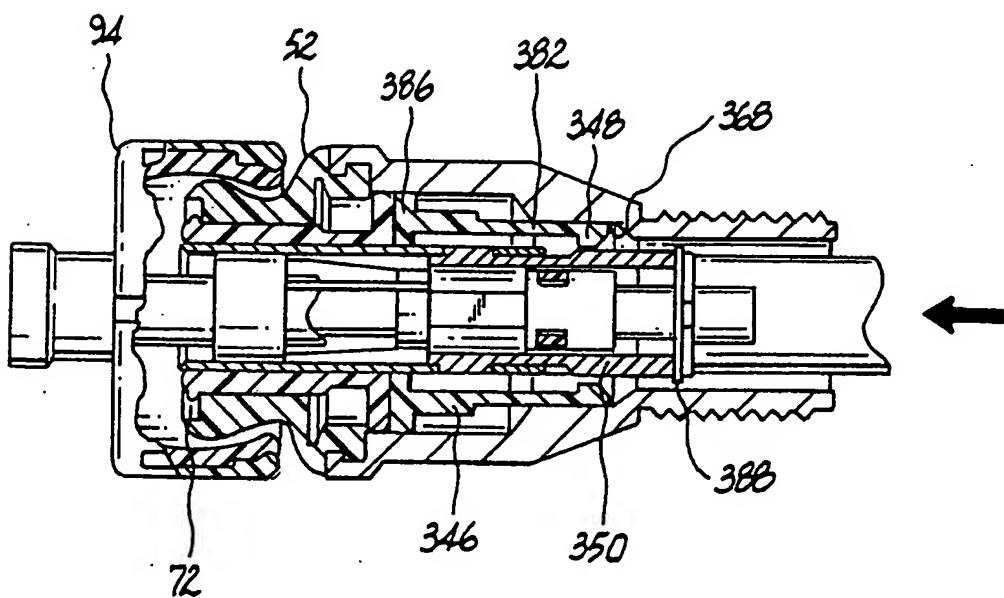


FIG. 34

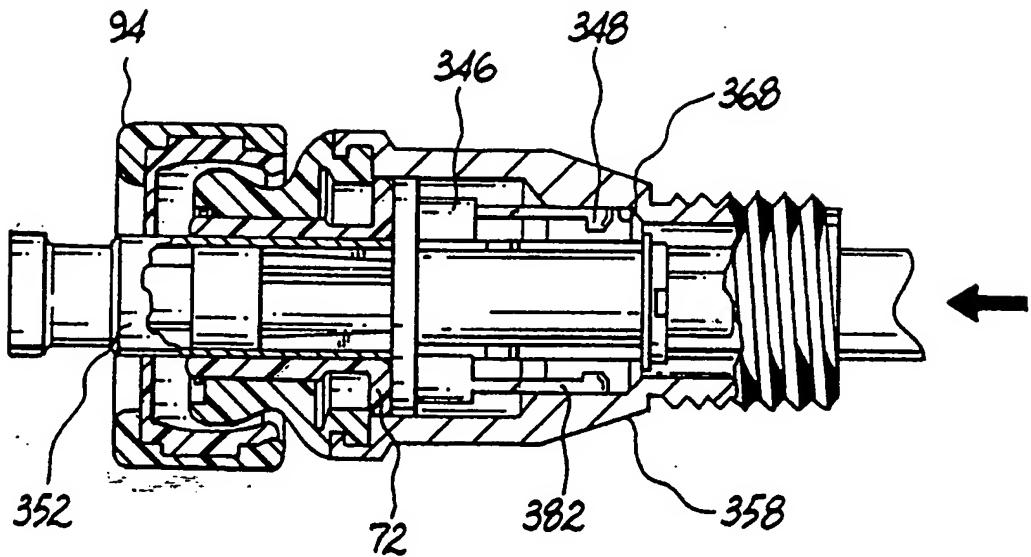


FIG. 35

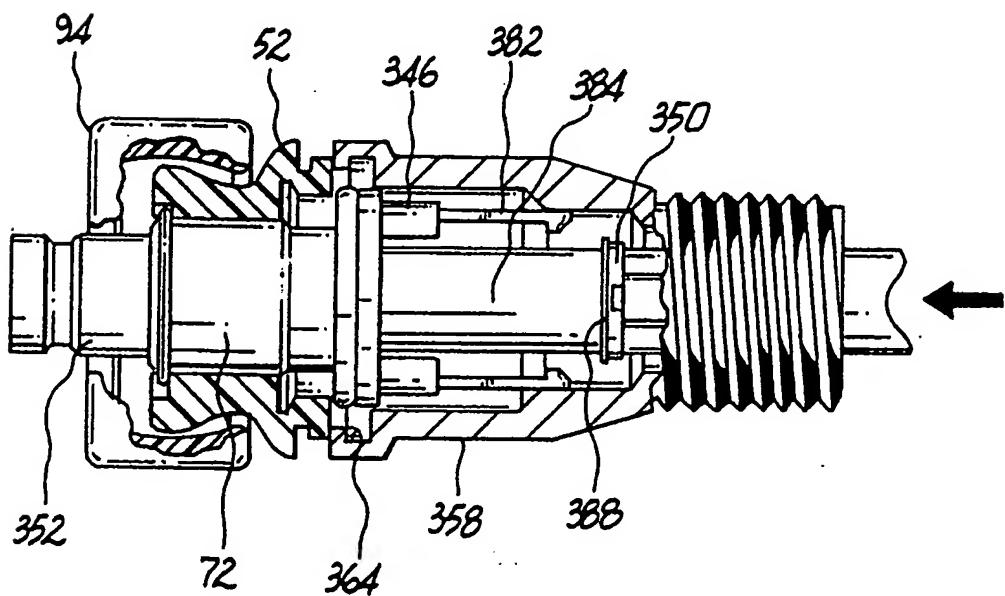


FIG. 36